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4 System Receiver

General Information

A satellite broadcast network consists of three major subsystems:

- Satellite link;
- Satellite transmission uplink station; and
- One or more remote satellite receivers, which have 3 major components:
  - satellite antenna subsystem;
  - link cable between the antenna and the receiver system; and
  - satellite audio receiver.

The satellite antenna and its associated electronics collect and convert the signal from the satellite's C- or Ku-band signal to L-band (950 to 1700 MHz). This signal is then sent through the link cable to the satellite receiver.

The purpose of the TVRO system receiver is to:

- Receive the satellite signal from the feedhorn;
- Separate the WORLDNET baseband audio and video signals; and
- Distribute the WORLDNET signals to the connected output devices: the distribution amplifier, video monitors, televisions, videocassette recorders, and site-optional equipment, such as Wegener receivers.

The system receiver must be compatible with the video transmission standard of the incoming signal to ensure a high-quality television picture. (See video transmission standards in Chapter 6, Monitors.) Some system receivers require accessories for adequate reception, while other models include an internal switching network that eliminates picture streaking and color distortion.

Analog Receiver Description

Tune to and accept: Single Radio Frequency (RF) signals from a C-Band or Ku-Band low-noise block downconverter (LNB) in the frequency range of 950-2050 MHz.

Video output: Original phase alteration by line (PAL) or National Television Standards Committee (NTSC) formats.

Audio output: Both balanced and unbalanced forms, and in both mono and stereo channels.

Digital Receiver Description

Accept: Compressed RF signal from a C-Band or Ku-Band low-noise block downconverter (LNB) in the frequency range of 950-2050 MHz. Digital receivers have built-in video and audio decompression processors.

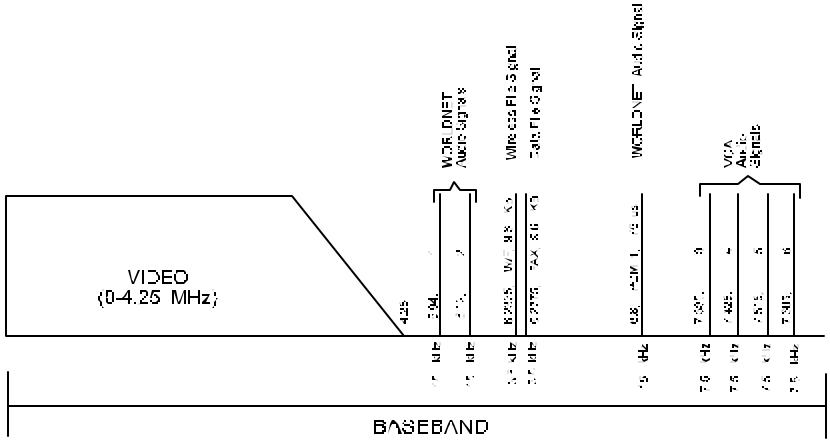
Video output: Original PAL or NTSC formats.

Audio output: Both balanced and unbalanced forms, and in both mono and stereo channels.

Broadcast Signal Spectra

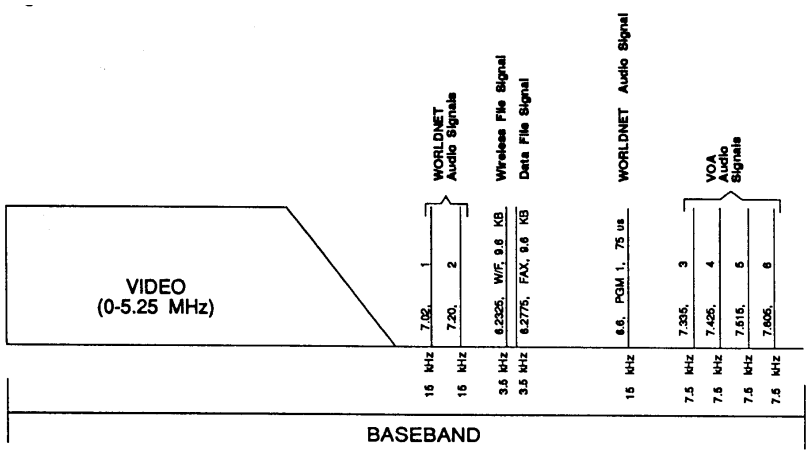
Figures 4.1 and 4.2 illustrate the frequency band spectra of WORLDNET's broadcast signals for NTSC and PAL. Additional subcarrier signals within each spectrum are used by the Wegener receiver, which is described later in this chapter.

Figure 4.1, WORLDNET Broadcast Signal Spectra (NTSC)



National Television Standards Committee (NTSC) Signal Spectra

Figure 4.2, WORLDNET Broadcast Signal Spectra (PAL)



Phase Alteration by Line (PAL) Signal Spectra

Terms

Acronyms, terms, and definitions useful in the following sections are listed here.

TERM	DEFINITION
AC	Alternating Current
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
Ampere (amp)	The unit of measure of current flow. One ampere equals 1 coulomb of electrons passing a given point in 1 second.
Amplifier	An electronic device that increases the strength of an electrical impulse with respect to the impulse's frequency.
Analog Signal	A signal transmitted on a continuously varying electromagnetic wave
ASCII	American Standard Code for Information Interchange
Attenuation	A term used to measure the decrease in magnitude in transmission from one point to another. It may be expressed as a ratio or in decibels.
Attenuator	An adjustable transducer for reducing the amplitude of a wave without introducing appreciable distortion.

TERM	DEFINITION
Band-Pass Filter	A filter allowing only frequencies within a certain range to continue, while blocking lower and higher range frequencies
Bandwidth	The range of frequencies occupied by a signal or passed by a transmission channel (7.5 KHz or 15 KHz).
Baseband Frequencies	The band of frequencies containing the information prior to modulation or after demodulation.
Bit Error Checking (BEC)	A method for checking a binary data stream for bit errors, sometimes called Viterbi Forward Error Checking (FEC)
Bit Error Rate (BER)	A measure of the accuracy of digital demodulation or decoding.
Bit Rate	The speed of digital transmission measured in bits per second.
BNC	A cable connector type
BPSK	Binary Phase-Shift Keying
Carrier	The radio frequency wave that is modulated by the baseband information signal.
C-Band	RF signal frequencies in the range, 3.7 – 4.2 GHz
Composite Baseband	The raw demodulator output, prior to filtering. Contains all transmitted subcarriers.
Connector	A socket, jack, or port on a piece of equipment into which a cable or wire connects.
Current	The flow or rate of flow of electrons in a conductor from a point of higher concentration to one of lower concentration. Usually measured and expressed in amperes.
DC	Direct Current
Decibel (dB)	A unit for measuring the volume of a sound.
De-Emphasis Network	An electronic network that modifies the input spectrum of audio frequencies to provide a flat spectrum.
Demodulation	The recovery of baseband information from a modulated carrier.
Deviation	The level of modulation of an FM signal.
Digital Data	Data formed by rapidly sampling the voltage of an analog signal and converting the samples into binary numbers
DIP	Dual Inline Processing

TERM	DEFINITION
DTR	Data Terminal Ready. One of the handshake requirements in a data transmission interface
FDM	Frequency Division Multiplex. Single or multiple-channel per carrier operation
FEC	Forward Error Correction
Frequency	The number of complete oscillations per second of an electromagnetic wave. 1 cycle per second = 1 hertz (Hz) 1,000 cycles per second = 1 Kilohertz (KHz) 1,000,000 cycles per second = 1 Megahertz (MHz) 1,000,000,000 cycles per second = 1 Gigahertz (GHz)
Frequency Modulation (FM)	The baseband signal is caused to vary by the frequency of the carrier wave.
Hertz (Hz)	The unit of frequency, one cycle per second.
High-Pass Filter	A filter allowing high frequencies to continue, while blocking low frequencies
IDU	Indoor Unit
IF	Intermediate Frequency. A commercial, industrial-standard frequency, 70 MHz
Impedance	An Electrical property which is equal to the ratio of voltage to current flow
K-Band	The frequency spectrum from 10.9 to 36 GHz.
Knob	A round handle that can be turned.
Ku-Band	RF signal frequencies in the range, 10.95 - 12.75 GHz
L-Band	RF signal frequencies in the range, 950 to 1700 MHz
LED	Light Emitting Diode
Line Amplifier	A device used to amplify an incoming signal before reaching the system receiver
Local Oscillator (LO)	A stable signal source used in the Block Downconverter to reduce the incoming signal frequency to a lower range
Low-Pass Filter	A filter allowing low frequencies to continue, while blocking high frequencies
Megahertz (MHz)	1 million hertz.
Modulation	The impression of information upon an RF carrier wave by varying some parameter of that wave.

TERM	DEFINITION
MPEG	Moving Picture Experts Group
MUSICAM	An MPEG Layer 2 audio decompressor
Noise Source	Any signal that interferes with the desired signal
NTSC	National Television Standards Committee
ODU	Outdoor Unit
Ohm (Ω)	The unit of electrical resistance present in a circuit.
Outlet	A wall 110V or 220V AC electrical source or a terminal strip 110V AC source.
PAL	Phase Alteration by Line. A German video transmission standard
PCM	Pulse Code Modulated
PLL	Phase-Locked Loop
QPSK	Quadrature Phase-Shift Keying
RF	Radio frequency
SCART Cable	An electrical cable connecting a positioner/tracker to a system receiver, enabling automatic transfer of satellite tracking data from the receiver to the positioner/tracker
SECAM	Séquence Couleur a Mémoire, Color Sequence with Memory. A French video transmission standard
Signal Splitter	A device used to divide a broadband signal into different frequency ranges for different receivers
Signal/Noise Ratio	The ratio, usually expressed in decibels, of the strength of a desired signal to that of the extraneous noise that is present.
SPST	Single pole single throw
Subcarrier	An information carrying wave which modulates the main carrier in a communications system. Subcarriers are used for independent audio and data transmission.
Switch	A lever or button that can be moved from one position to another.
TDM	Time Division Multiplexing. Single or multiple-channel per carrier operation
Terminal	A socket jack, or port, on a piece of equipment into which a cable connects.

TERM	DEFINITION
TTL	Transistor-Transistor Logic – Logic circuits consisting of two or more directly interconnected transistors intended to drive capacitive loads at high rates.
Volt (v)	The unit of measure for potential difference.
Volt-Ampere (VA)	Unit of apparent power equal to the product of voltage and current.

COMSTREAM ABR200 Audio Broadcast Receiver

Overview

The ABR200 is a multiple transmission rate, QPSK/BPSK digital audio receiver. It processes the signal and provides audio, data, and control signals to the receiver station equipment that has been supplied to the post.

The ABR200 is composed of two elements, an outdoor unit and an indoor unit. The outdoor unit consists of a low-noise LNB that mounts directly to the antenna. The indoor unit is a compact, fully integrated, digital receiver. It is composed of:

- An L-band demodulator;
- A single micro-controller providing overall receiver control and configuration;
- A single DSP-based audio decoder providing two audio outputs;
- A relay control port;
- An RS-232 asynchronous audio port; and
- An RS-232 remote control/diagnostic port.

The receiver is normally rack mounted, requiring only 1.75 inches of vertical space. All input and output connections are made on the rear panel. Each connector is unique in size or gender from the other, so that no interconnection mistakes can be made during installation.

For installations that require multiple stereo pair outputs, two or more receivers can be connected together. In this configuration, the L-band RF input is passed through to each additional receiver in turn, and is demodulated, decoded, and output as an independent audio channel. Up to six receivers can operate from one low noise block downconverter (LNB) and antenna.

Features

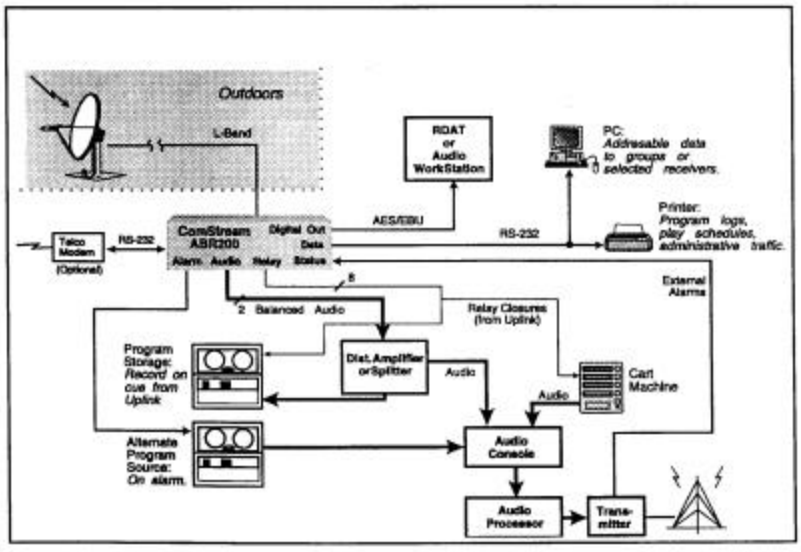
Key features of the ABR200 are the following:

- Full 20 kHz CD-quality audio at 128, 192, or 256 Kbps;
- Ku- or C-band operation, BPSK or QPSK;
- ISO/MPEG algorithm that has international backing, has significant ongoing international research and development, and is subject to independent performance assessment and measurements;
- Quick, nearly transparent, audio channel changes for receiving multiple channels;

- Relay (cue) control port with eight contact closures, each independently controllable from the uplink;
- Six TTL inputs for local channel changes and auxiliary equipment monitoring;
- Addressable receiver providing complete control of receiver configuration and operation from the uplink;
- Audio channel changes either locally or from the uplink;
- Low-speed (300 to 4800 baud) asynchronous data port;
- Remote control capability, with access by an external wireline modem;
- Built-in audio, relay control, data port diagnostics;
- Built-in performance monitoring measures lowest received energy per bit with respect to noise (Eb/No) and counts RF and audio sync losses;
- Receiver software can be upgraded over satellite link; and
- Nonvolatile memory for all configuration and operating parameters.

Figure 4.3 shows the ABR200 installed in a typical application, such as a radio station environment.

Figure 4.3, Typical ABR200 Installation

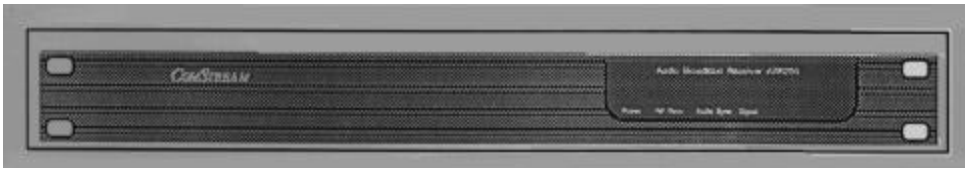


The analog output audio is used to feed both the on-air studio console and taping equipment for off-hours distribution of programmed material. The relay contact closures are used to control station equipment such as cart machines and tape recorders. The data port can be connected to a low-speed dot matrix printer or a

personal computer (PC) for station traffic, air logs, and so on. The alarm relay closure is used to activated an alternate program source in the event the satellite channel becomes inoperative.

The ABR200 chassis is mechanically and electrically strong, meeting worldwide emissions, safety, and power requirements. The chassis design uses overlapping joints, so that electrical high voltages cannot be probed from outside the chassis box. The ABR200 contains a power supply that can sense and adapt to any AC power source automatically. Figure 4.4 shows the front panel of the ABR200 receiver.

Figure 4.4, The ABR200 Front Panel



Operations

Front Panel Indicators

The front panel on the ABR200 receiver has six indicators located on the right side of the panel, as shown in Figure 4.5. The indicators are backlighted to show active operations or fault conditions in the ABR200.

Figure 4.5, ABR200 Front Panel Indicators

The front panel indicators are:

Power Indicator

This green Light Emitting Diode (LED) indicates that the unit is powered on and that the power supply is functioning properly.

RF Sync Indicator

This indicator turns green to indicate that acquisition of the incoming RF signal is complete and the RF signal is being processed.

Audio Sync Indicator

This indicator turns green to indicate that the digital audio decoder is synchronized to the uplink audio encoder. High-quality audio is available for output from the receiver, if the receiver has been authorized for audio reception by the uplink.

Signal Indicator

The Signal Indicator is a green LED that indicates the current signal strength compared to criteria specified by the user. The indicator has three operational states: ON, BLINKING, and OFF. The signal-level thresholds that determine these three states are specified by the user, using the computer commands Q0 and Q1 described in the Command Description section. These threshold levels are preset to the default values shown in Table 4.1.

TABLE 4.1, THRESHOLD LEVEL DEFAULT VALUES

SIGNAL LEVEL (EB/NO)	INDICATOR
>7.0 dB	On
>4.0 dB, <7.0 dB	Blinking
<4.0 dB	Off

IDU Fault Indicator

The IDU (Indoor Unit) Fault Indicator illuminates IDU Fault in red. When the indicator is on, it indicates one or more fault conditions exist that may prevent or seriously affect signal reception. The conditions under which the indicator turns on are set by the user, as described in the Command Description section. This indicator follows the state of the Status Relay Closure Contact that is located on the rear panel of the receiver. Once the fault conditions have cleared, the indicator turns off automatically.

During the power-up sequence, the fault indicator will light briefly (indicating that the LED is working), then turn off. Once the power-up sequence is complete, the fault indicator remains invisible unless a fault has occurred.

Another function that involves the IDU indicator is the updating of ABR200 receiver software. The ABR200 software can be updated over the satellite link. Interrupted or unsuccessful software downloads will make the IDU fault indicator blink at 1-second intervals. The fault indicator will stop blinking only when the download is successful.

ODU Fault

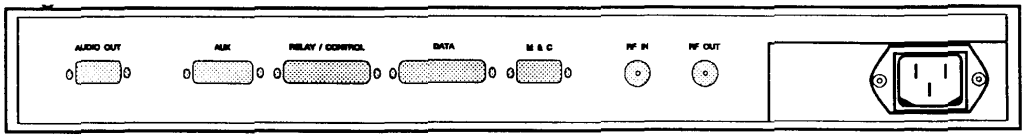
The ODU (Outdoor Unit) fault indicator illuminates ODU Fault in red on the front panel. When unlit, "ODU Fault" is not readily visible. When lit, the LED indicates that the low-noise amplifier/block downconverter (LNB) is not receiving power from the IDU. This indicator may be programmed to remain off using the OM command, as described in the *Operations* section.

Rear Panel Connections

This section describes the physical and electrical connections to the ABR200 receiver. All external connections to ABR200 are made at rear panel connectors. The ABR200 has eight possible connections on the rear panel. The location of these connectors is shown in Figure 4.6. Each connector is different in either size or type from the others (except for RF IN and RF OUT), so that errors in making connections are minimized.

4	All signal cables connected to the receiver should be shielded. The shield must be electrically attached to the mating connector.

Figure 4.6, ABR200 Rear Panel Connectors



AUDIO OUT

This connector type is DB9, male (Analog Audio). The AUDIO OUT port provides the analog audio output for left and right audio channels. The outputs are direct coupled, actively balanced, and with the capacity to drive into 600 ohm impedances. To protect against circuit damage during short circuits, a series current-limiting resistor (30 ohm) is placed between the output operational amplifier and the connector.

When operating in the mono mode, only the left output is supplied with the audio signal. A mating female DB9 connector, with metal shell cover, should be used to connect to studio equipment. The interconnecting cable should be a shielded, twisted-pair audio cable.

See Table 4.2 for pinout assignments for this connector:

TABLE 4.2, ANALOG OUTPUT PORT PINOUT ASSIGNMENTS

CONNECTOR TYPE: DB-9 MALE			
PIN #	**I/O**	**NAME**	**DESCRIPTION**
1	O	LO+	Left Audio Output (+)
2	O	LO-	Left Audio Output (-)
3	--	Not Used	
4	O	RO+	Right Audio Output (+)
5	O	RO-	Right Audio Output (-)
6	O	AGND	Analog Ground
7	--	Not Used	
8	--	Not Used	
9	O	AGND	Analog Ground

AUX, Auxiliary Port

This connector type is DB15, female, and provides a variety of signals for optional use:

- Status relay contacts;
- Digital audio output;
- AGC monitor voltage; and
- Synchronous RS-422 receive clock/data output.

See Table 4.3 for the pinout assignments for this connector. A description of these assignments is given in the following paragraphs.

TABLE 4.3, AUXILIARY PORT PINOUT ASSIGNMENTS

CONNECTOR TYPE: DB-15 FEMALE			
PIN #	**I/O**	**NAME**	**DESCRIPTION**
1	O	SG	Signal Ground
2	O	Status+	Status Closure Contact 1
3*	O	RD-	Receive Data RS-422 (-) [A]
4*	O	RT-	Receive Timing RS-422 (-) [A]
5	O	AGC	AGC Output Voltage 0-10 VDC
6*	I	BBRT-	Baseband Rec. Timing RS-422 (-) [A]
7*	I	BBRD-	Baseband Rec. Data RS-422 (-) [A]
8	O	DIGOUT-	AES/EBU Digital Audio Out (-)
8	O	Status-	Status Closure Contact 2
10*	O	RD+	Receive Data RS-422 (+) [B]
11*	O	RT+	Receive Timing RS-422 (+) [B]
12	I	MCRESET-	M&C Port Reset
13*	I	BBRT+	Baseband Rec. Timing RS-422 (+) [B]
14*	I	BBRD+	Baseband Rec. Data RS-422 (+) [B]
15	O	DIGOUT+	AES/EBU Digital Audio Out (+)

* Special configuration required.

The Status Relay contacts are made at this connector. The Status Relay output provides an external indication of errors in the satellite receiver system operation. The Status Relay follows the front panel IDU fault indicator, and consists of a contact closure that remains inactive during normal operation.

When an error condition is observed, the relay will activate, allowing the error event to be detected. The sense of the relay may be programmed to be either **inactive open** or **inactive closed**, using the **SS** command described in the Command Description section. The Status Relay may be used to switch in an alternate audio source feed or to trigger an audio alarm to alert the operators that a problem exists.

An important feature of the Status Relay is its ability to be programmed to trigger under specific fault conditions. These fault conditions are detected while others are ignored. The Status Relay can be customized for your receiving site's requirements. The status relay mask, **SR**, command provides this customizing ability. Refer to the Command Description section for details about this command.

Under normal operating conditions, there is a short circuit between pins 1 and 2. If a fault occurs or the power supply fails, the connection becomes an open circuit.

4	The Status Relay output should not be used to switch currents greater than 1 ampere

A digital pulse-code-modulated **(PCM)** audio output is also available. This interface operates according to the AES/EBU interface specification. This output permits direct connection to studio equipment or digital audio tape recorders that support the AES/EBU interface. Higher quality audio is possible since all of the digital-analog and analog-digital conversion noise is alleviated with digital PCM.

For assistance in antenna pointing, an analog version of the automatic gain control (AGC) is made available on this connector. The analog voltage range is from **0** to **10 VDC**. This voltage is measured relative to the signal ground also present on the connector.

The undecoded audio data stream is made available on this connector as RS-422 data and clock. This interface operates synchronously. The output data is synchronized with the falling edge of the receive timing clock, which is also provided. Possible use for these data is that the encoded audio data stream can be directly stored onto a storage device, such as a hard disk, for playback at a later time into a MUSICAM decoder or the ABR200.

RELAY/CONTROL

This connector type is DB-25, male, and provides various signals for relay or control purposes. The relay control port provides eight separate form A (SPST) relay contacts that are controlled from the uplink. Each contact can be programmed independently or in combination with other contacts. The polarity (normally open or closed) can be selected either locally or from the uplink. The relay contacts are intended to be used to control external equipment, either audio or other station equipment.

See Table 4.4 for the pinout assignments for this connector. A description of these assignments is given in the following paragraphs.

TABLE 4.4, RELAY CONTROL PORT PINOUT ASSIGNMENTS

CONNECTOR TYPE: DB-25 Male							
Pin #	**I/O**	**Name**	**Description**	**Pin #**	**I/O**	**Name**	**Description**
1	O	RC1A	Relay Closure Contact 1A	9	I	SI1	Sensor Input 1, TTL
14	O	RC1B	Relay Closure Contact 1B	10	I	SI2	Sensor Input 2, TTL
2	O	RC2A	Relay Closure Contact 2A	11	I	SI3	Sensor Input 3, TTL
15	O	RC2B	Relay Closure Contact 2B	22	I	SI4	Sensor Input 4, TTL
3	O	RC3A	Relay Closure Contact 3A	23	I	SI5	Sensor Input 5, TTL
16	O	RC3B	Relay Closure Contact 3B	24	I	SI6	Sensor Input 6, TTL
4	O	RC4A	Relay Closure Contact 4A	12	I	SI7	Sensor Input 7, TTL
17	O	RC4B	Relay Closure Contact 4B				
				25	O	SG	Signal Ground
5	O	RC5A	Relay Closure Contact 5A	13	O	+12 V	+12 V through 220 ohm
18	O	RC5B	Relay Closure Contact 5B				(5 ma max) resistor
6	O	RC6A	Relay Closure Contact 6A				
19	O	RC6B	Relay Closure Contact 6B				
7	O	RC7A	Relay Closure Contact 7A				
20	O	RC7B	Relay Closure Contact 7B				
8	O	RC8A	Relay Closure Contact 8A				
21	O	RC8B	Relay Closure Contact 8B				

Seven TTL sensor inputs are provided for external control of channel selection or for ancillary equipment monitoring. These inputs can be monitored directly using the **SI** command. See the Command Description section for specific details about this. The first three inputs allow the selection of up to eight different RF audio channels by connecting a rotary switch to the inputs. The RF channel frequencies are preset either locally or from the uplink.

The second group of three inputs can be used to trigger an automatic call to the uplink facility when activated. See the description under the **FL** command in the Command Description section for more details. The seventh input is currently unused.

Also available on this port is +12 VDC. The output is current-limited to 50 milliampere (ma). One possible use for this voltage is to support interfacing to coupled inputs of user equipment.

DATA

The connector type is DB-25, female (RS-232), and provides an asynchronous RS-232 data output. These data are a portion of the audio data stream transmitted from the uplink. Data rates up to 4800 baud possible. You can define the functions of this port using the **P1** command as described in the Command Description section. Flow control is not implemented for this interface.

See Table 4.5 for the pinout assignments for this connector:

TABLE 4.5, USER DATA PORT PINOUT ASSIGNMENTS

CONNECTOR TYPE: DB-25 MALE							
PIN #	**I/O**	**NAME**	**DESCRIPTION**	**PIN #**	**I/O**	**NAME**	**DESCRIPTION**
1	O	SG	Signal Ground	16*	O	AUXRD	Aux Rcv Data RS-232 (Rsrvd)
2	I	TD	Transmit Data (Reserved)	17	--	--	Not Used (Reserved)
3	O	RD	Receive Data	18	--	--	Not Used (Reserved)
4	O	SG	Signal Ground	19*	I	AUXDTR	Aux Data Terminal Ready (Rsrvd)
5	--	--	Not Used (Reserved)	21	--	--	Not Used (Reserved)
6	O	DSR	Data Set Ready	22	-	--	Not Used (Reserved)
7	O	SG	Signal Ground	23	--	--	Not Used (Reserved)
20	I	DTR	Data Terminal Ready	24*	O	AUXRD+	Aux Rcv Data RS-422 (+) (Rsrvd)
				25*	I	AUXTD+	Aux Tsmt Data RS-422 (+) (Rsrvd)
8	--	--	Not Used (Reserved)				
9	--	--	Not Used (Reserved)				
10	--	--	Not Used (Reserved)				
11*	O	AUXRD-	Aux Rcv Data RS-422 (-) (Rsrvd)				
12*	I	AUXTD-	Aux Tsmt Data RS-422 (-) (Rsrvd)				
13*	O	AUXDSR	Aux Data Set Ready (Rsrvd)				
14*	I	AUXTD	Aux Tsmt Data RS-232 (Rsrvd)				
15	--	--	Not Used (Reserved)				

*Special Configuration required.

M&C (Monitor & Control)

This connector is a DB9, female (RS-232). The Monitor and Control port is used to connect an RS-232 control terminal or telephone modem to the ABR200. During normal system operation, commands are received from the uplink through the control channel. However, control and diagnostic commands can also be issued to the receiver through this port. During normal operation, the front panel LED indicators will display summary failure information. The M&C port is used to provide detailed information on the ABR200 status.

This port is setup by using the **P2** command, as described in the Command Description section. See Table 4.6 for the pinout assignments for this connector.

TABLE 4.6, M&C PORT PINOUT ASSIGNMENTS (SPECIAL CONFIGURATION REQUIRED)

CONNECTOR TYPE: DB-9 Female, RS-232/RS-485			
Pin #	**I/O**	**Name**	**Description**
1*	I	TD+	Transmit Data, RS-485 (+)
2	O	RD	Receive data, RS-232
3	I	TD	Transmit Data, RS-232
4	I	DTR	Data Terminal Ready
5	O	SG	Signal Ground
6	O	DSR	Data Set Ready
7*	I	TD-	Transmit Data, RS-485 (-)
8*	O	RD+	Receive Data, RS-485 (+)
9*	O	RD-	Receive Data, RS-485 (-)

* Special configuration required.

If a modem (such as a Hayes-compatible modem) is connected to the M&C port, it is possible to establish a return link by terrestrial phone lines to the uplink terminal. This enables remote performance monitoring of the receiver site by the uplink site.

4	The data terminal ready (DTR) lines must be active for proper operation. Default port settings are 2400 baud, 7 data bits, 1 stop bit, and odd parity.

If this port has been reprogrammed, you can reset the default settings by performing the following procedures:

1. Connect the MCRESET (AUX port, pin 12) pin to signal ground (AUX port, pin 1).
2. Turn off the ABR200 power.
3. Turn the ABR200 power back on.
4. Disconnect pin 12 from pin 1.

RF IN

This connector is an F-type, 75 ohm, female (RF). **RF IN** is the primary input to the receiver. The RF signal is brought into the receiver through this connector. ABR200 units may be connected by attaching the **RF OUT** of one unit to the **RF IN** of another. The RF input connector supplies power at +18 VDC (500 mA max) to the LNB downconverter through the link cable between the LNB and the ABR200 receiver. See Table 4.7 for RF In parameters.

TABLE 4.7, RF IN PARAMETERS

Input carrier power	-75 dBm to -30 dBm
RF frequency	950 MHz to 1700 MHz
Total power in the 950 MHz to 1700 MHz band	< 5 dBm
Input impedance	75 ohms, with a return loss of greater then 9 dB

RF OUT

This connector is an F-type, 75 ohm, female. The RF OUT connector provides a buffered duplicate of the signal presented to the RF input connector. The RF OUT can be used to:

- Connect an L-band video receiver for receive-only video applications;
- Connect additional ABR200 receivers for simultaneous reception of multiple audio channels;
- Diagnose problems in system performance; and
- Aid in pointing an antenna.

The frequency range of the Video Output is identical to that of the receiver, 950 MHz to 1700 MHz. The gain of the Video Output is –2 dB to +5 dB; nominal +2 dB. The output impedance is 75 ohms, with a return loss greater than 9 dB.

POWER CONNECTOR

This connector type is IEC 320, male socket. The ABR200 power supply is auto-ranging from 85 to 265 VAC and 47 to 63 Hz. Maximum power supply output for the ABR200 is 52 watts. The normal power consumption for the ABR200 is 35 watts. There is no power On/Off switch on the receiver. Remove the AC power cable from the unit to turn the power off.

For receiver sites outside North America, the appropriate certified termination plug for the power cord must be installed.

The power cord wires are color-coded:

- Green and Yellow: earth/ground;
- Blue: neutral; and
- Brown: live.

If the color code described does not correspond to the colored markings identifying the terminals in your termination plug, complete the following procedures:

The green and yellow wire must be connected to the terminal in the plug marked by the letter E or by the earth symbol, or colored green and yellow.

The blue wire must be connected to the terminal marked with the letter N or colored black.

The brown wire must be connected to the terminal marked with the letter L or colored red.

Receiver Control

In audio distribution networks, the ABR200 is normally setup and controlled from the uplink station. In this configuration, the receiving site does not usually need to communicate directly with the receiver. However, during receiver installation, troubleshooting, or for performance monitoring, direct communication may be required.

This section describes the on-site operation of the receiver through the M&C port. Complete monitoring and control of the receiver is available using an ASCII computer terminal connected to the RS-232 monitor and control port (M&C port) located on the rear panel of the unit. Alternatively, a telephone modem may be connected to the M&C port, allowing control from a remote (off-site) terminal. Operation of the ABR200 in this way is not covered in this manual (See the *ComStream ABR200 Operation Manual* for specific instructions on this control alternative).

When you control the ABR200 receiver from an on-site terminal, you can input commands to display and set ABR200 parameter. ABR200 codes are output by the receiver to indicate errors, faults, or current status. The next subsections discuss the following:

- The ABR200 command syntax;
- Each functional group of commands; and
- Errors, faults, and status codes.

Command Syntax

Commands are input to the ABR200 by sending a sequence of ASCII characters to the receiver M&C Port. For installation instructions, refer to the *TVRO Installation Guide*. Each message sequence consists of several parts:

- An escape character (optional);
- A two-letter command string;
- A single space;
- An optional parameter; and
- The [Enter] key.

All characters following [Enter], and before the next escape character, are ignored. Commands may be entered in either upper or lower case.

In the following syntax models, the angle brackets (< >) are not to be typed when entering commands into the terminal. They are used here to separate the different parts of the command for clarity. In this example, the optional escape character in front of the command is not used.

<command> <space> <parameter> [Enter]

Most commands are used to set internal parameter values or to determine their current value. Parameters may consist of:

- A single digital number – identified as "n";
- A multiple digital number – identified as "nnnnn";
- A single ASCII character – identified as "s"; or
- An ASCII character string – identified as "string".

Parameter values are determined by replacing the numerical value in the command with a question mark (?) character or by entering [Enter] immediately following the two-character command.

∫	<command> <space> ? [Enter] or <command> [Enter]

Each of these commands requests the receiver to display a current parameter value. Some commands do not have parameters associated with them. These commands are terminated with only [Enter]. The second example above shows the syntax for a command that does not require a parameter (such as **RE, DC, DP**, and others).

The receiver will perform command actions if:

- The command is valid;
- The parameter value is within the valid range;
- The parameter value or command is compatible with the present receiver configuration; and
- The command can be executed immediately.

Commands that do not follow these guidelines will produce an error code. Command errors occur when a command has been mistyped, is inappropriate, or cannot be executed immediately. The normal response of the receiver is to display one of the error codes shown in Table 4.8.

TABLE 4.8, COMMAND ERROR CODES

ERROR CODE	DESCRIPTION
ER1	Command Format Error
ER2	Parameter Out of Range
ER3	Command Not Supported by Configuration
ER4	Command Temporarily Not Supported

Password Protection

To protect against unauthorized access to the receiver, a login password is provided. The default for this password is **HOMEYD**. *It is important to pay attention to the case of the letters in the password*. For other commands, it is not important as character case is not distinguished. To change the password, use the **PC** command.

Command Groups

Most commands are used to set the operating characteristics of the receiver. These commands install parameter values into the receiver memory that remain in effect unless changed by the receiver operator. You should avoid changing settings unless you are certain of the result. Most of the operating parameters are set at the uplink at the time of installation and do not change except under specific condition.

ABR200 commands are grouped into nine functional areas:

- L-band Demodulator;
- Channel Control;
- Audio Port;
- Data Port;
- Relay Port;
- M&C Port;
- Alarm/Status;
- Front Panel; and
- Miscellaneous.

4	The detailed use and syntax of individual commands is presented in the alphabetical list following the functional grouping as shown in Table 4.9.

TABLE 4.9, COMMANDS

FUNCTIONAL GROUP	SYNTAX	USE
L-Band Demodulator Commands	AG	ACG Gain Factor
	AO	Acquisition Offset
	AQ	Acquisition Mode
	B1	Primary Search (Binning) Range
	B2	Secondary Search (Binning) Range
	B3	Overall Search (Binning) Range
	CE	Channel Error Rate

FUNCTIONAL GROUP	SYNTAX	USE
	DC	Display Configuration of Receiver
	DQ	Data Rate Query
	EB	Eb/No Signal Level Query
	EM	Eb/No Minimum Register
	LO	Local Oscillator Offset
	RB	Read Calculated Bit Error Rate
	RF	Read RF Value
Channel Control	CC	Channel Configuration
	FD	Format Definition
	FS	Format Select
	LA	Logical Address Definition
	LC	Local Format Change Permission
	NS	Network Status
	PD	Preset Definition
Audio Port	AS	Audio Status
	AT	Audio Test
	LR	Left/Right Channel Toggle
	MU	Audio Mute
	M0	Eb.No Mute On
	M1	Eb/No Mute Off
Data Port	P1	User Data Port Configuration
	X1	Exercise User Data Port
Relay Port	CM	Relay Contact Mapping
	CO	Relay Contact Control
	CQ	Relay Contact Query
	CS	Relay Contact Sense
M&C Port	BY	Bye – Logout
	EE	Echo Terminal Input
	P2	M&C Port Configuration
	PC	Password Change
	X2	Exercise M&C Port
Alarm/Status	AL	Alarm Reporting
	CF	Clear Fault Register
	ET	Eb/No Alarm Threshold Level
	EX	Maximum Eb/No
	FL	Fault Query
	HM	Hex Mode
	NF	Number of Signal Fade
	SI	TTL Sensor Input Query
	SL	Audio Sync Loss Counter

FUNCTIONAL GROUP	SYNTAX	USE
	SR	Status Relay Mask
	SS	Status Relay Sense
	ST	Status Query
Front Panel	OM	ODU Fault Mask
	Q0	Low-Signal Quality Threshold Level
	Q1	High-Signal Quality Threshold Level
Miscellaneous	AP	CS8204 Inputs
	DE	Composite Data Port Enable
	DM	Display Message
	DP	Display Parameters of Receiver
	DX	Decoder Data source
	EN	Enable Network Data
	ID	Receiver ID Query
	MR	Master Reset
	P3	Printer Port Configuration
	RE	System Reset

Command Descriptions

An alphabetical listing of the individual commands is given below with the command two-letter code, the command title, the appropriate syntax for the command, and an explanation of its usage. As appropriate, examples are provided.

AG AGC Gain Factor

Syntax: **AG** <space> ?

This command displays the gain factor applied to the received signal. During normal operation, the gain factor is constantly and automatically adjusted so that the receiver baseband signal is amplified to the same level regardless of input signal strength. A displayed value of 255 means that no signal is present. A value of 0 means that the received signal is too strong.

AL Alarm Reporting

Syntax: **AL** <space> ?

AL <space> n

This command enables/disables the automatic reporting of alarms to the M&C port. This command has no effect on the operation of other commands such as **ST** and **FL**. The status of the faults can still be monitored by the AL query command.

VALUE	SETTING
0	Enable fault reporting

1 [default]	Disable fault reporting

AO Acquisition Offset Frequency

Syntax: **AO** <space> ?

This command displays the offset frequency from which acquisition will begin. The default value for this frequency is **0** MHz.

AP CS8204 Inputs

Syntax: **AP** <space> n or

AP <space> ?

This command configures the AES/EBU interface. This interface provides a digital PCM audio output on the AUX port connector of the ABR200. This interface operates according to the AES3-119X (ANSI S4.40-199X) interface specification. This specification allows transmission of control information along with the digital audio data stream.

The ABR200 uses the CS8204 digital transmitter manufactured by Crystal Semiconductor. The CS8204 is operated only in the professional (PRO) mode. The **AP** command provides users with access to the inputs of the CS8204 that specify the control information to be transmitted.

In the **AP** command, "n" is the decimal equivalent of the bit map of the CS8204 control interface a shown in Table 4.10.

TABLE 4.10, CS8204 CONTROL INTERFACE

BIT POSITION	CS8204 PIN NAME	FUNCTION	DECIMAL WEIGHT
0	EM 0	Encoded encoder emphasis	1
1	EM 1	Encoded encoder emphasis	2
2	C1/	Inverse of channel status bit 1	4
3	C6/	Inverse of channel status bit 6	8
4	C7/	Inverse of channel status bit 7	16
5	C9/	Inverse of channel status bit 9	32
6	CRE	Sample address counter control	64
7	Not Supported		128

The inputs to the CS8204 are encoded as shown in Table 4.11 (with the asterisks indicating default values).

TABLE 4.11, CS8204 INPUT CODES

PIN NAME	INPUT STATE	OPTION SELECTED
EM 0, EM 1	*1, 1	Receiver defaults to no emphasis, manual override enabled.
	0, 0	CCITT J-17 emphasis, no override.
	1, 0	50/15 µsec emphasis, override disabled.

PIN NAME	INPUT STATE	OPTION SELECTED
	0, 1	No emphasis, manual override disabled.
C1/	0	Non-audio mode.
	*1	Normal audio mode.
C6/, C7/	*1, 0	Sampling frequency = 48 kHz, no override or autosetting.
	1, 1	Sampling frequency defaults to 48 kHz with manual of autosetting enabled.
C9/	*0	Stereophonic mode, channel 1 is left, manual override is disabled.
	1	Receiver defaults to 2 channel mode, manual override enabled.
CRE	*0	Sample address counter reset.
	1	Local sample counter and reliability flag are internally generated.

The default value for AP is 15.

AQ Acquisition Mode

Syntax: **AQ** <space> n

AQ <space> ?

This command sets the type of acquisition mode and queries the receiver for the currently active acquisition mode. The value of "n" specifies what type of acquisition the receiver is to perform. If queried (that is, if "?" is entered in the command syntax), the receiver reports back the status of the acquisition mode.

Acquisition is the process the receiver uses to adjust its frequency, phase, gain, and synchronization to match the incoming RF carrier. The ABR200 performs these adjustments automatically for both installation and for signal fade out. Table 4.12 shows the different types of acquisition and the corresponding action or status each represents:

TABLE 4.12, ACQUISITION

TYPE	ACTION	STATUS
0	Disable acquisition	Acquisition disabled/complete
1	Initiate fade acquisition	Fade acquisition in progress
2	Initiate power-on (start-up) acquisition	Power-on (start-up) acquisition in progress
3	None	Channel change acquisition in progress

An acquisition mode of **0** indicates that acquisition has been disabled or that the previous acquisition is complete. When the ABR200 achieves RF sync and audio sync, it sets the acquisition mode to 0 to indicate that the previous

acquisition was successfully completed. When you enter **AQ 0**, this command instructs the ABR200 to disable all acquisition processes.

4	Entering a value of **0** for **n** in the acquisition mode command will disable any acquisition in progress. The ABR200 will *not* begin another acquisition until you enter one of the commands: **AQ 1**, **AQ 2**, or **FS n**. Disabling acquisition is usually not desirable.

A fade acquisition is automatically initiated whenever RF sync is lost while the receiver is locked onto a carrier. A power-on acquisition will begin searching for the RF carrier at the frequency specified by the user. The start acquisition frequency is determined by the ABR200 from the value of the RF parameter that is entered in the channel configuration, **CC**, command. In addition, the ABR200 will add the offset frequency that is entered in the acquisition offset, **AO**, command to the start acquisition frequency.

A channel change acquisition is normally performed when the ABR200 is receiving one RF carrier or RF channel, and is then instructed to switch to another RF carrier. The **FS** command is used for this purpose, not the **AQ** command. The **FS** command is used because this command programs the ABR200 with all of the necessary channel parameters for the new RF carrier. The ABR200 needs these channel parameters to achieve RF and audio sync on the new RF carrier. Since the ABR200 begins this process already locked onto one RF carrier, it already contains information on the acquisition frequency offset to use in the search for the new RF carrier. It uses this value, which has been entered using the local offset, **LO,** command in its calculations for the start acquisition frequency. The ABR200 will search only one frequency bin for the new carrier. If it does not succeed, then it will return to the last RF frequency it was receiving and perform a fade acquisition for it.

4		A detailed description of the "binning and acquisition" processes used by the ABR200 receiver is in *ABR200 Owner's Manual, Chapter Three: Functional Description and Theory of Operation*.

AO Acquisition Offset

Syntax: **AO** <space> ?

This command displays the value of the acquisition offset frequency. It is used for display purposes only. The acquisition offset value is used by the ABR200 in its calculations for the frequency at which it will begin its search for the RF carrier in a power-on acquisition. The value of **AO** is automatically updated whenever the local frequency drift (**LO**) of the RF carrier exceeds 1 MHz. Also, the value of **AO** is stored so that on subsequent power-on acquisitions, the ABR200 will use this value to shorten the time needed to find the new RF carrier.

AS Audio Status

Syntax: **AS** >space> ?

This command queries the receiver for the current audio status. If the audio is enabled, a value of "**0**" is displayed. If the audio is disabled (muted), a non-zero-value is displayed. The value that is displayed when the audio is disabled is a

number, which is the weighted sum of the conditions causing the audio to be muted. The weights associated with different conditions causing the audio to be muted are shown in Table 4.13.

TABLE 4.13, CONDITIONS AND WEIGHTS

MUTE CONDITION	WEIGHT (HEX)	WEIGHT (DEC)
No RF sync	0x01	1
Low Eb/No	0x02	2
Internal mute (MU=1)	0x04	4
No audio sync	0x08	8
Not authorized to receive audio	0x10	16
System mute	0x20	32
Acquisition mute	0x40	64

AT Audio Test

Syntax: **AT** <space> n, [length] or

AT <space> ?

This command selects the audio test that the digital audio signal processor will perform. In this command, "n" is the number of the audio tests to be performed. The parameter [length] is an optional parameter that specifies the length of time (in seconds) that the selected test is to run. This length of time can range from 1 to 65535 seconds. If no parameter is given for [length], that is, if it is left blank, then the selected audio test will run until it is terminated manually with an **AT 0** command. Valid parameter values are 0 to 7. See Table 4.14 for the tests to be performed.

4	When this command is operated over the satellite control channel without a length parameter, the test will run for only 5 seconds.

TABLE 4.14, TESTS

PARAMETER VALUE	TEST
0 [default]	None, normal operating state
1	1 kHz tone, left channel
2	1 kHz tone, right channel
3	1 kHz tone, both channels
4	Built-in audio processor test
5	9.6 kHz tone, left channel
6	9.6 kHz tone, right channel
7	9.6 kHz tone, both channels

When operating these commands from the M&C port, the selected test runs continuously. If operated through the ANMS satellite control channel, the test

runs for 5 seconds. When **AT 4** is processed, the built-in tests execute continuously until halted (by setting **AT** not equal to **4**) or a fault occurs. The DSP software version number is also displayed.

Table 4.15 provides performance specifications for the audio tests.

TABLE 4.15, PERFORMANCE SPECIFICATIONS

TEST	FREQUENCY	OUTPUT LEVEL	THD	TERMINATION
AT3	1.00 kHz	+4.00 dBm	0.01%	100K ohm
AT3	1.00 kHz	+3.25 dBm	0.01%	600 ohm
AT3	1.00 kHz	+1.11 dBm	0.01%	150 ohm
AT7	9.6 kHz	+4.00 dBm	0.01%	100K ohm
AT7	9.6 kHz	+3.25 dBm	0.01%	600 ohm
AT7	9.6 kHz	+1.11 dBm	0.01%	150 ohm

B1 Primary Search (Binning) Range

Syntax: **B1** <space> ?

This command is a query-only command that displays the value of the frequency range that is searched first for a new RF carrier (the Primary or **B1** bin). The value of this parameter is determined by the symbol rate and is given in units of kHz.

The values of **B1** and **B2** (Secondary Search Range) are used together in an acquisition procedure. When performing a Fade Acquisition, the **B1** range is searched first for the carrier signal. If the carrier is not found in the **B1** frequency range, the frequency range given by the **B2** parameter is searched above and below the **B1** range simultaneously. After searching the **B2** ranges, the **B1** range is searched again. The search then expands to the next outer **B2** ranges, and then back to **B1** again. This pattern is expanded until the acquisition range limit (**B3**) is reached. When the search reaches this range limit without success, the search pattern is repeated from the beginning.

B2 Secondary Search (Binning) Range

Syntax: **B2** <space> ?

The **B2** command is a query-only command that displays the value of the secondary frequency range that is searched when a fade acquisition occurs. The value of **B2** is determined by the symbol rate and is given in units of **kHz**. **B2** is the frequency range to search for the RF carrier outside the **B1** range. If the carrier has not been located when all the **B2** ranges are exhausted, the search begins again.

B3 Maximum Search (Binning) Range

Syntax: **B3** <space> nnnn

B3 <space> ?

This command is used to specify the maximum frequency range that is searched when the ABR200 is attempting to acquire the RF carrier. This range applies to both the Installation Acquisition and the Fade Acquisition modes. Suitable values for the "nnnn" parameter are between 0 and 4,000,000 in units of Hertz. This value of **B3** is added to and subtracted from the sum of the RF frequency plus the acquisition offset defined by **AO**. This determines the maximum frequency range to be searched. Entering a "**?**" causes the current **B3** value to be displayed.

Default values for **B3** are 2,000,000 when operating with a DRO LNB and 200,000 when operating with a PLL LNB.

BY Bye – Logout

Syntax: **BY**

This command performs a manual logout. The receiver logs out automatically after 5 minutes of inactivity at the M&C port.

CC Channel Configuration

Syntax: **CC** <space> channel_n, RF_nnnn,RR_nnnn,RM_n

CC <space> channel_n,ZAP

CC <space> channel_n <space> ?

CC <space> ?

This command sets the configuration for the specified channel. The channel number "**n**" is used to define the required parameters for a particular channel. Access to a particular channel is determined by the format definition, **FD**, command and the format select, **FS**, command. Both the channel configuration and format definition must be successfully defined before the ABR200 can receive an audio signal. The parameter list includes:

Channel_n Channel number "**n**" to be configured. Valid channel numbers are **0** to **31**. This value must correspond to the channel identifier (**CI**) programmed at the uplink.

RF_nnnn Specifies the RF input frequency "nnnn" to be received by the LNB. The ranges of valid frequencies are: 3.7-4.2 GHz, 10.95-11.699 GHz, 11.7-12.2 GHz, and 12.25-12.75 GHz. All values are entered in units of 1000 Hz (1 kHz). For example:

For the Ku-band: 8 digits are required for "nnnn".

For the C-band: 7 digits are required for "nnnn".

RR_nnnn Specifies the receive symbol rate "nnnn" in symbols per second (sps). Valid symbol rates are: 12800, 192000, 256000, 384000, and 512000 sps (for the ABR200-1), and 64000, 128000, 192000, 256000, and 512000 sps (for the ABR200-2).

RM_n Specifies the receive modulation type. 0 = BPSK; 1 = QPSK.

∫	The following command configures channel 1 for a Ku-band frequency for 11,700,000 kHz, 256000 sps symbol rate, and QPSK modulation **CC** 1,11700000,256000,1

Entering the letters "**ZAP**" for the channel configuration parameters clears the values of **RF**, **RR**, and **RM** in the channel specified by "**n**". The channel is no longer configured.

To display the channel configuration parameters associated with a particular channel number "n", use the syntax:

CC <space> Channel_n <space> ?

To display the channel configuration parameters of all defined channels, use the syntax:

CC <space> ? or **CC**

The default value is "not defined".

CE Channel Error Rate

Syntax: **CE** <space> ? or **CE**

This command displays the current calculated channel error rate. The value is a 2-digit integer. The first digit is the numerical rate; the second digit is the exponent of the power of ten, which multiplies the first digit. For example:

If **CE** is 65, the channel error rate = 6×10^{-5}

The lowest channel error rate that is displayed is 09 (0×10^{-9}).

CF Clear Fault Register

Syntax: **CF** <space> nn

This command clears active faults and permits monitoring for those faults to begin again. Once a fault is set, no further occurrences of the fault can be monitored until the fault register is reset.

All faults are set during power-up, and therefore you must clear them before fault alarm messages are sent to the diagnostic port.

Parameter values for "nn" are integers in the range of **0** to **30**. **CF** 0 will clear all active faults. Other values for "nn" correspond to the bit number of a fault as defined in the fault register (Refer to the **FL** and **ST** command descriptions for a complete list of all fault code bit numbers).

CM Relay Contact Mapping

Syntax: **CM** <space> channel_n,r1,r2,r3,r4,r5,r6,r7,r8

CM >space> channel_n <space> ?

This command allows the receiver to be configured to provide a mapping of relay contacts that exist at the uplink to the relay contacts that exist at the ABR200 receiver. A contact map is stored for each channel number, and is recalled

whenever the channel is changed using the **FS** command. Channel numbers can range from **0** to **31**.

The eight parameters "**r1**" through "**r8**" correspond to the eight receiver relays. The "**r1**" parameter corresponds to the mapping for receiver relay **1**; the "**r8**" parameter corresponds to the mapping for receiver relay **8**. The values of **r1** through **r8** represent the relay input at the uplink that is assigned to operate the designated receiver relay. Acceptable values for **r1** through **r8** are **1** to **16**. The value "**1**" is the first uplink relay input, "**2**" is the second uplink relay input, and so on, until "**16**" is the most significant relay input. The default mapping for **CM** is: **1,2,3,4,5,6,7,8** for all formats.

∫	**CM** 3,3,2,1,4,5,6,10,7 will perform the following relay mapping when channel 3 is selected by the **FS** command:

UPLINK RELAY INPUT	RECEIVER RELAY
3	1
2	2
1	3
4	4
5	5
6	6
10	7
7	8

CO Relay Contact Control

Syntax: **CO** <space> string

CO <space> ?

This command allows the receiver relays to be temporarily activated and deactivated for test purposes. The "string" in the command is an 8 byte character string that controls the state of each relay. The first character controls relay number **1**, the second controls relay number **2**, and so on. Valid characters that can be used in the "string" are:

- **0 -** deactivates a relay;
- **1 -** activates a relay; and
- X relay action based on uplink relay input.

The default setting for this command is **CO** XXXXXXXX.

∫	The following command activates relay contacts **1**,**4**, and **5**, while not changing the other contacts in use **CO** 1XX11XXX
4	Make sure that the settings are returned to the **X** character after you are finished, so relay closures are controlled from the uplink again. If this is not done, the relay closures will remain in the state specified in the **CO** command.

	relay closures will remain in the state specified in the **CO** command.

CQ Relay Contact Query

Syntax: **CQ** <space> ?

This command displays the physical state of the receiver's relay closures. The value displayed is an 8 character value. Each character represents the status of an individual relay. A "**0**" for a relay means that the relay is open, and a "**1**" means that the relay is closed. The first character corresponds to receiver relay contact one, and the last character corresponds to relay eight.

CS Relay Contact Sense

Syntax: **CS** <space> string

CS <space> ?

This command sets the normal (deactivated) position for the control relays. The "string" is an 8-character string. The first character position controls relay number one, and the last character position controls relay number eight. A "**1**" for an individual character means that the relay is normally closed and that the relay is activated by opening it. A "**0**" for an individual character means that the relay is normally open and that the relay is activated by closing it.

The default value for **CS** is **00000000** (all relays are normally open).

DC Display Configuration of Receiver

Syntax: **DC** <space> ? or **DC**

This command displays a summary output of the present control software and symbol rate configuration of the receiver. Two possible displays may appear, depending upon the type of receiver: ABR200-1, or ABR200-2.

For ABR200-1:

ComStream Digital Audio Broadcast Receiver

Software Version [xxxxx, 1.36]

QPSK rates: 112 128 192 256 384 Kbps

BPSK rates: 64 96 128 192 256 Kbps

For ABR200-2:

ComStream digital Audio Broadcast Receiver

Software Version [xxxxx, 1.36]

QPSK rates: 64 112 128 192 256 384 Kbps

BPSK rates: 64 96 128 192 256 Kbps

4	The leftmost version number represents a software version number that has been downloaded from the satellite. For receivers that have not downloaded their software from the satellite, the place holder "xxxxx" is displayed.

DE Composite Data Port Enable

Syntax: **DE** <space> n or

DE <space> ?

This command enables and disables the composite baseband data that is to be the output on the auxiliary port connector. The composite data is the encoded ISO/MPEG data stream.

The interface operates synchronously with the data that is valid on the falling edge of the clock timing pulse. RS-422 electrical levels are used for this interface. The pinouts for this interface are given in the *TVRO Installation Guide*.

VALUE	SETTING
0	Disable the output of the composite baseband data
1 [default]	Enable the data

DM Display Message

Syntax: **DM** <space> Pn,string

This command provides a means of sending an ASCII character string to the output port designated by **Pn**. The valid port numbers are **P1** (data port) or **P2** (M&C port). The string terminates with a [Enter], which executes the command and is not part of the string.

A vertical bar character "|" can be used to force the output of a [Enter] to the designated port.

DM Display Parameters of Receiver

Syntax: **DP** <space> ? or **DP**

This command requests a summary output of all command parameters that have only one value. Commands that have multiple parameter sets such as **FD** or **CM** are not displayed. This command does not require an input parameter. It is equivalent to issuing a request for every available command.

DQ Data Rate Query

Syntax: **DQ** <space> ?

This command requests the receiver for the current channel data rate. The value returned is the data rate in bits per second.

DX Decoder Data Source

Syntax: **DX** <space> n or

DX <space> ?

This command selects the input source for the audio decoder on the ABR200. A value of **0** for **n** will instruct the receiver to use the output of the L-band demodulator as the input to the audio decoder. A value of **1** or **2** will instruct the

receiver to use the external data input on the Auxiliary port (pins 6, 7, 13, 14) as the input to the audio decoder. The input interface operates according to the RS-422 electrical levels and requires the input data to be valid on the falling edge of the clock timing pulse.

If the **DX** command is set to **1**, it can be overridden during carrier acquisition to ensure that the input to the audio decoder comes from the L-band demodulator. The receiver monitors the incoming composite data stream for the proper network/channel ID that it needs to achieve RF and audio sync. Once RF and audio sync have been achieved, the receiver returns the **DX** command parameter to the state it was in before the start of carrier acquisition.

If **DX** is set to **2**, the receiver disables all carrier acquisition processes and will not switch the input to the audio decoder from the auxiliary port under any circumstances.

Syntax: **EB** <space ? or **EB**

This command requests the receiver to display the present energy per bit with respect to noise (Eb/No) in a 1 Hz bandwidth on the channel.

An estimate of the Eb/No is displayed in the range of **0 dB** to **20 dB** for rate 1/2 coding. The Eb/No value is determined in 0.1 dB procedures with an accuracy of 0.3 dB in the range between 4.0 and 10 dB. This value is valid approximately 20 seconds after ABR200 acquisition and is updated every 5 seconds.

The Eb/No value can be used to initiate several receiver functions such as muting audio (see **M0** and **M1** commands), activating the Eb/No threshold (**ET**) alarm, and setting the condition of the front panel signal indicator (**Q0** and **Q1**).

EE Echo Terminal Input

Syntax: **EE** <space> n

EE <space> ?

This command specifies whether characters input to the M&C port on the ABR200 are echoed at the M&C port output. Echoing "sends back" each character received so that it appears on the display of the M&C port CRT terminal.

VALUE	SETTING
0	Disable the echo
1 [default]	Enable the echo

EM Eb/No Minimum Register

Syntax: **EM** <space> 0

EM <space> ?

This command requests the receiver for the minimum Eb/No value that was measured since the last time the minimum value was reset.

EM 0 will reset the minimum value of Eb/No to the highest possible Eb/No value. The minimum value is not affected if the receiver loses lock. The default value is **20**.

EN Enable Network Data

Syntax: **EN** <space> n or

EN <space> ?

This command allows the user to enable and disable the output of the network ID information through the RS-232 data port (pins 14, 16). The network ID information is generated at the uplink multiplexer, and contains network ID, channel ID, and relay information.

VALUE	SETTING
0 [default]	Disable the output of this information
1	Enable the output of this information.

If the receiver is not authorized to receive relay information (see **FD** command), then the network ID data output is disabled regardless of the state of the **EN** command.

ET Eb/No Alarm Threshold Level

Syntax: **ET** <space> n.m or

ET <space> ?

This command configures the receiver for a minimum Eb/No threshold. An Eb/No threshold error is generated whenever the value of Eb/No is strictly less than the **ET** value. The format for the threshold number is **n.m**, where **0 < n £ 20**, and **0 £ m £ 9**.

The default value is **3.5**.

EX Eb/No Maximum

Syntax: **EX** <space> 0

or

EX <space> ?

This command requests the receiver to display the maximum value for Eb/No recorded since the last maximum value was reset. **EX 0** will reset the value to the lowest possible Eb/No value.

FD Format Definition

Syntax: **FD** <space> format_nn,network_ID_nnn,channel_nn, unit_authorization_n

FD <space> format_nn,ZAP

FD <space> format_nn ? or format_nn

FD <space> ? or **FD**

This command sets the specified format number for a particular network, RF channel, and unit authorization value. Values for format numbers can be set from **0** to **63**. Network values can be set from **0** to **255**.

4	The format number matches the network ID defined at the uplink DAC.

Channel_nn corresponds to the channel number as defined by the **CC** command. The possible range is **0**-**31**.

The unit authorization selects what services are output from the receiver audio, data, and relay contact closures. The authorization bit map is as follows:

Bit 0	0-audio disable	1-audio enable
Bit 1	0-user data disable	1-user data enable
Bit 2	0-relay port disable	1-relay port enable

UA Value	Active Ports
0	None
1	Audio only
2	User data only
3	Audio and user port
4	Relay port only
5	Audio and relay port
6	Data and relay port
7	Audio, data and relay port

∫	To set format 6 to be assigned to network 1, RF channel 3, with authorization to receive audio and relay closures only, the following parameters should be used: **FD** 6,1,3,5

If an error is made in a parameter entry, simply retype the command with the correct parameters.

Once a format is defined, the configuration is made operational by using the format select, **FS**, command. The RF channel that is used, along with the associated receiver parameters, is specified by the channel number within the format definition.

To delete a format definition, the parameter value "**ZAP**" is used. To display all active format definitions, use the command **FD** followed by a [Enter]. The default value is "not defined".

FL Fault Query

Syntax: **FL** <space> ? or **FL**

FL <space> 0

This command requests the receiver for the current fault status. Fault codes and response values are retained in a fault register. Each bit and associated fault weight is assigned to a particular fault indication. The fault/status map is listed below. The bits in the fault register are identical to those in the status register (see **ST** command). If the hex mode (**HM**) is enabled (**1**), then the output is displayed in hexadecimal format. All bits are displayed that are set. If the hex mode is disabled (default setting), then the output value is the sum of all set fault bits.

∫	If faults 17 and 18 are active, the displayed value for the **FL** ? command is: 196608 (decimal) or 0x00030000 (hex)

If the command format **FL** <space> 0 is used, then every active fault number is displayed, one per display line. Thus, for the example above, the **FL** 0 command results in the display of the two faults: The fault status/map is pictured in Table 4.16.

FL17

FL18

TABLE 4.16, COMPLETE FAULT/STATUS MAP:

FAULT NUMBER	FAULT NAME	HEX WEIGHT	DECIMAL WEIGHT
1	Not used	0x00000001	1
2	Not used	0x00000002	2
3	Not used	0x00000004	4
4	Not used	0x00000008	8
5	AGC fault	0x00000010	16
6	Bit time lock fault	0x00000020	32
7	Carrier lock fault	0x00000040	64
8	FEC decoder sync fault	0x00000080	128
9	Acquisition range fault	0x00000100	256
10	Carrier tracking range fault	0x00000200	512
11	Not used	0x00000400	1024
12	Bit time range fault	0x00000800	2048
13	Non-volatile memory fault	0x00001000	4096
14	Carrier tracking DDS fault	0x00002000	8192
15	Bit time DDS fault	0x00004000	16384
16	Watchdog timeout fault	0x00008000	32768
17	Audio PLL lock fault	0x00010000	65536
18	Audio decoder sync fault	0x00020000	131072
19	DSP watchdog fault	0x00040000	262144
20	DSP bit failure	0x00080000	524288
21	Sensor input 4	0x00100000	1048576
22	Sensor input 5	0x00200000	2097152
23	Sensor input 6	0x00400000	4194304
24	Outdoor unit fault	0x00800000	8388608
25	Eb/No threshold fault	0x01000000	16777216
26	Not used	0x02000000	33554432
27	EPROM checksum fault	0x04000000	67108864
28	S/W download failure	0x08000000	134217728
29	Channel change fault	0x10000000	268435456
30	Network ID fault	0x20000000	536870912
31	Channel change ID fault	0x40000000	1073741824

FS Format Select

Syntax: **FS** <space> format_nn

FS <space> ?

This command selects the receiver parameters specified by the format number in the **FD** command. Values for the format number can be from **0** to **63**. An **FS** ?

displays the format that is in operation. For example, assume that the current format in operation is number 1. An **FS** ? command would display **FS 1**. To change the format to number 2, enter **FS** 2. The default value for **FS** is "not defined".

HM Hex Mode

Syntax: **HM** <space> n

HM <space> ? or **HM**

This command assigns the display format for the **ST** and **FL** commands to be decimal or hexadecimal. Values for **n** are: **0** for display decimal format; and **1** for display hexadecimal format. A query displays the current format. The value for **HM** is not stored in nonvolatile memory. Therefore, upon a power-up event or a login event from the remote terminal, **HM** defaults to **0** (**decimal format**).

ID Receiver ID Query

Syntax: **ID** <space> ?

This command displays the ABR200 ID serial number, which is used for individual unit addressing. The number should be identical to the unit serial number as displayed on the real panel.

LA Logical Address Definition

Syntax: **LA** <space> nn,address)nnnnn

LA <space> ? or LA

This command allows the receiver to respond to logical addresses that are received over the network control channel. Up to 32 logical addresses can be assigned to each receiver. Values for the parameter address_nnnnn can range from 1 to 16383. Specifying a parameter of "**0**" for the address has the effect of clearing the logical address assignment. The receiver will respond to all logical addresses assigned, and to its unique physical address (unit **ID**).

∫	**LA** 3,9312 sets logical address number 3 to a value of 9312. The receiver will act upon network control messages addressed to unit 9312.

The default value for **LA** is no logical addresses assigned.

LC Local Format Change Permission

Syntax: **LC** <space> number

LC <space> ?

This command allows the receiver channel to be configured through the three external TTL inputs. This command works with the preset definition, **PD**, command.

A value of "**1**" enables the receiver to enact format changes through the external TTL inputs. A "**0**" disables this feature. The default value is **0**.

LO Local Oscillator Offset

Syntax: **LO** <space> ? or **LO**

The **LO** value represents the difference between the frequency at the start of an acquisition and the frequency at which the RF carrier was actually located. The LO value represents the sum of the frequency offsets that are present at the receive site. These offsets include the offset present in the local oscillator of the LNB and the local oscillator of the receiver. Knowing the actual offsets present at the receive site, the ABR200 can optimize it's acquisition process. When performing a channel change acquisition, the receiver will use the offset specified in the **LO** value to calculate the frequency at which it will start its search for the new RF carrier.

LR Left/Right Channel Toggle

Syntax: **LR** <space> n or

LR <space> ?

This command instructs the receiver to reverse the assignment of the left/right audio channels.

VALUE	POSITION
0 [default]	Normal
1	Reverses left/right channels

M0 Eb/No Mute On

Syntax: **M0** <space> n.nor

M0 <space> ?

This command allows for muting the output audio based upon the received signal strength, Eb/No. It is used with the **M1** command, which enables the output audio. The audio is muted when the Eb/No value is at or below the specified Eb/No value. The default value for **M0** is **4.0**. The possible range of values is from **0.0** to < "**M1 value**".

M1 Eb/No Mute Off

Syntax: **M1** <space> n.n or

M1 <space> ?

This command allows for unmuting the output audio based on the received signal strength, Eb/No. It is used with the **M0** command, which mutes the output audio. The audio is unmuted when the Eb/No value is at or above the specified Eb/No value. The default value for **M1** is **4.5**. The possible range of values is > **M0** up to **20.0**.

MR Master Reset

Syntax: **MR** <space> n or

MR <space> ?

This command resets the receiver to all of its original default settings. The value of n determines the type of re-initialization that will occur. As a safety feature, two identical **MR** commands must be issued within a 10-second period before the receiver will begin to reinitialize its parameters.

VALUE	SETTING
0	factory default settings for a **DRO LNB**
1	factory default settings for a **PLL LNB**

MU Audio Mute

Syntax: **MU** <space> ? or

MU <space> ?

This command allows the operator to mute the audio output of the receiver.

VALUE	SETTING
0 [default]	Disable the audio mute function
1	Mute the audio output

4	Even though **MU** = 0, there may be other conditions that will cause the audio to mute. Refer to the AS command for these conditions.

NF Number of Signal Fades

Syntax: **NF** <space> ? or **NF**

NF <space> 0

This command displays the number of RF signal fades since the counter was last cleared. Channel changes do not increment the counter. **NF 0** resets the counter.

NS Network Status

Syntax: **NS** <space> ? or **NS**

This command displays the current network parameters received over the control channel. The network ID number, the channel ID number, and the relay contact closure status are displayed.

OM ODU Fault Mask

Syntax: **OM** <space> n

OM <space> ? or **OM**

VALUE	SETTING
0	Disables the ODU fault indicator
1 [default]	Enables the ODU fault indicator

This command controls the operation of the front panel ODU fault indicator. This command is set to **0** when the RF input is connected to another ABR200 receiver.

P1 User Data Port Configuration

Syntax: **P1** <space> baud,parity,data bits,stop bits

P1 <space> ? or **P1**

This command sets the user data port for the specified operating parameters. Possible values for these parameters are:

Baud	0, 300, 1200, 2400, 4800, 9600
Parity	O (odd), N (none), or E (even)
Data bits	7 or 8
Stop bits	1 or 2

A "**0**" for the baud rate parameter disables the user data port independent of the unit authorization. The default value is **2400,0,7,1**.

P2 M&C Port Configuration

Syntax: **P2** <space> baud,parity,data bits,stop bits

P2 <space> ?

This command sets the diagnostic port for the specified parameters. Possible values for these parameters are:

Baud	0, 300, 1200, 2400, 4800, 9600
Parity	O (odd), N (none), or E (even)
Data bits	7 or 8
Stop bits	1 or 2

The default values are **2400,O,7,1**.

P3 Printer Port Configuration

Syntax: **P3** <space> baud,parity,data bits,stop bits

P3 <space> ?

This command sets the printer data port for the specified parameters. Possible values for these parameters are:

Baud	0, 300, 1200, 2400, 4800, 9600
Parity	O (odd), N (none), or E (even)
Data bits	7 or 8
Stop bits	1 or 2

The default value for this command is **2400,O,7,1**.

PC Password Change

Syntax: **PC** <space> current password, new password,new password

This command allows the operator to change the password of the receiver. A password must be between **5** and **10** alphanumeric characters.

∫	To change the default password of "HOMEYD" to the new password "ABC123", enter the following: PC HOMEYD, ABC123, ABC123

PD Preset Definition

Syntax: **PD** <space> preset_n,format_n

PD <space> preset_n ? or PD

This command allows the receiver to be configured for seven format presets. The presets are used with the external status inputs in selecting formats. The **LC** command enables or disables the capability of the receiver to change formats using presets.

Possible values for preset_n are from **0** to **7**. Possible values for **format_n** are from **0** to **63**. A value of **0** for the format indicates that there is no assigned format for a given preset. Presets are used with the external TTL inputs, which select the desired preset. SI3-SI1 have internal 4.7 K pullups. A dry closure to ground creates a logical address to "0". An open circuit represents a "1".

The mapping for the TTL input-to-preset is:

TTL Inputs			
SI3	**SI2**	**SI1**	**Preset Number**
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1

TTL Inputs			
SI3	**SI2**	**SI1**	**Preset Number**
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Inputs are active "0", low

Q0 Low-Signal Quality Threshold Level

Syntax: **Q0** <space. n.n

Q0 <space> ? or **Q0**

This command sets or reads the lower limit signal strength threshold. The receiver used the values set in **Q0 andQ1** to report the current status of the signal strength. The receiver compares **EB** with **Q0** and **Q1** and reports the signal strength through the front panel SIGNAL indicator.

If EB > **Q1** SIGNAL LED is on

If **Q0** < EB < **Q1** SIGNAL LED will blink

If EB < **Q0** SIGNAL LED is off

The default value for **Q0** is **4.0 dB**.

Q1 High-Signal Quality Threshold Level

Syntax: **Q1** <space> n.n

Q1 <space> ? or **Q1**

This command sets or reads the upper limit signal strength threshold. The receiver uses the values set in **Q0** and **Q1** to report the current status of the signal strength through the front panel SIGNAL indicator.

The default value for **Q1** is 7.0 dB.

RB Read Calculated Bit Error Rate

Syntax: **RB** <space> ? or **RB**

This command displays the decoder estimated output bit error rate. The format for the bit error rate is n.n. The first number is the mantissa of the bit-error-rate threshold. The second number represents the negative of the exponent (that is, for n.n = 2.6, the number is 2×10^{-6} or 0.000002).

RE System Reset

Syntax: **RE** <cr>

This command resets the unit to a known state as defined by the stored parameters in nonvolatile memory. This command DOES NOT reset the unit to the factory default settings.

RF Read RF Value

Syntax: **RF** <space> ? or **RF**

The **RF** command is used to request the receiver to display the C- or KU-band frequency to be received at the input of the LNB. The range of downlink frequencies received by the ABR200 is 3.7-4.2 GHz, 10.95-11.699 GHz, 11.7-12.2 GHz, and 12.25-12.75 GHz. The RF frequency is set through the channel configuration, **CC**, command, and it is selected by the format select, **FS**, command.

SI TTL Sensor Input Query

Syntax: **SI** <space> ?

This command requests the receiver for the status of the seven TTL inputs. The value displayed is a seven-character string. Each character of the string represents the status of an input line. The first character corresponds to the TTL input #1; the last character corresponds to TTL input #7.

SL Audio Sync Loss Count

Syntax: **SL** <space> 0

SL <space> ?

This command allows the receiver to maintain a record of the number of audio sync losses since the last time the value was reset. The sync loss count will not exceed **65535**. **SL 0** resets the sync loss count value to zero.

SR Status Relay Mask

Syntax: **SR** <space> nnnn

SR <space> ? or **SR**

This command sets or reads the status relay mask. The value nnnn is a decimal number that represents the bit map of the faults to be monitored by the status relay. See the **FL** command for a listing of fault monitors and their decimal weighting. The default value for the status relay mask is **3749707775**, which enables all faults except **FL** 24 (ODU fault) and **FL** 30 (network ID fault) to activate the relay and front panel IDU fault indicator.

∫	To set faults 6, 7, and 8 Input 224 (32 + 64+128) as the value of **nnnn**

SS Status Relay Sense

Syntax: **SS** <space> number

SS <space> ?

This command sets the sense of the remote status relay. A value of "**0**" for the parameter number sets the relay sense to be "true". That is, under normal conditions, the relay is closed; when an alarm occurs, the relay is open. A value of "**1**" for the parameter number sets the relay sense to be "inverted". That is, under normal conditions, the relay is open; when an alarm occurs, the relay is closed. When the receiver has no power, the relay is open for both settings of **SS**. For a summary of these settings:

STATUS RELAY CONTACTS		
CONDITION	(SS=0)	(SS=1)
Power Off	Open	Open
Alarm	Open	Closed
Normal	Closed	Open

The default value for **SS** is **0**, that is true sense.

ST Status Query

Syntax: **ST** <space> or **ST**

This command displays the current content of the Status Register. Recall that the **FL ?** command displays all the faults that have occurred since the last time the Fault Register was cleared. The **ST ?** command, on the other hand, displays the current condition of those fault monitors. The bits in the status register are defined exactly as those in the fault register. The **ST** command will display either a decimal or hexadecimal encoded value of the bits in the Status Register depending upon the value set in the Hex Mode (**HM**) command.

X1 Exercise User Data Port

Syntax: **X1** <space> value

This command allows the user data port to be exercised by providing a repeating test pattern. A value of "**1**" enables the user data port test. A value of "**0**" disables the test. The test pattern that is issued to the data port is:

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789

The default value for **X1** is "**0**".

X2 Exercise M & C Port

Syntax: **X2** <space> value

This command allows the M&C port to be exercised by providing a repeating test pattern. A value of "**1**" enables the M&C port test. A value of "**0**" disables the test. The test pattern that is issued to the M&C port is:

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789

The default value for **X2** is "**0**".

Troubleshooting the ComStream ABR200

This troubleshooting section is provided to aid the user in isolating equipment problems and to suggest appropriate actions toward solving the problem. If a particular problem cannot be resolved after reviewing the following material, or if a ComStream equipment failure is suspected, then seek further assistance by contacting your system administrator.

4	Temporary, solar-related electromagnetic disturbances occur every year during the spring and autumn months. These disturbances usually persist for several minutes a day for approximately one week during these periods. For more information on solar outages, see Chapter 9, Standard Maintenance Procedures.

Fault Condition Descriptions

A detailed description of each fault condition is provided here to aid in troubleshooting.

FL5 — AGC Range Fault

This fault indication means the input signal to the demodulator is less than -90 dBm or greater then -30 dBm (approximately).

FL6 — Bit Time Lock Fault

This fault indication means the demodulator bit-time loop has lost lock. The receiver output data is disabled when this fault occurs.

FL7 — Carrier Tracking Lock Fault

This fault indication means the demodulator carrier-tracking loop has lost lock. The receiver output data is disabled when this fault occurs.

FL8 — AGC Range Fault

This fault indication means the decoder output BER is greater than 10^{-2} (approximately).

FL9 — Acquisition Failure

This fault indication means the demodulator has completed a search of all frequencies out to the limits defined by the **B3** parameter, and was unable to acquire a carrier.

FL10 — Carrier Tracking Range Fault

This fault indication means the demodulator carrier tracking register has reached its maximum (or minimum) setting.

FL12 — Bit Time Range Fault

This fault indication means the demodulator bit-time accumulator has reached its maximum (or minimum) setting.

FL13 — Nonvolatile Memory Fault

This fault indication means one of the parameters in the demodulator nonvolatile memory may have become corrupted. If this indication occurs repeatedly, the nonvolatile memory is defective.

FL16 — Watchdog Timer Fault

This fault indication means the demodulator microprocessor fault timer has failed to reset. FL16 normally indicates a memory fault, meaning the unit may be operating in an undesirable manner. When this fault occurs, the system automatically resets.

FL17 — Audio PLL Lock Fault

This fault occurs when the narrow band phase lock loop (PLL) that operates the audio digital-to-analog converter is not locked. Usually this is caused when RF sync is not achieved. If this alarm occurs by itself and will not clear by switching power off and on again, the receiver should be returned for servicing.

FL18 — Audio Sync Fault

This fault indicates that the receiver decoder is not in synchronization with the audio encoder at the uplink. This condition normally occurs if RF sync is not achieved.

FL19 — DSP Watchdog Fault

This fault indicates that the DSP audio decoder is not functioning normally. If this fault persists, then the unit should be returned for servicing.

FL20 — DSP Bit Failure

This fault indicates that the DSP audio decoder built-in tests did not successfully pass during start up. If this fault persists, then the unit should be returned for servicing.

FL21, FL22, FL23 — External Alarm Monitoring

All three of these faults are caused from monitoring an external device that produces a TTL logic "low" on Sensor inputs 4, 5, and 6. These signals are on the relay control port pins 22, 23, and 24.

FL24 — Outdoor Unit Fault

This fault indicates that the LNB is not drawing power from the receiver. If the receiver is connected to another ABR unit, this is a normal condition. The front panel ODU Fault indicator tracks this fault condition.

FL25 — Eb/No Threshold Fault

This fault indicates that the measured RF signal level (Eb/No) has dropped below the level set by the ET command.

FL27 — EPROM Checksum Fault

This fault indicates that the main control processor memory has been corrupted and is not functioning normally. If this fault persists, then the unit should be returned for servicing.

FL28 — Software Download Failure

This fault indicates that a software download was not successful. The control processor operates from the EPROM while this fault is active. Once the download is successful, this fault automatically clears. While this fault is set, the IDU Fault indicator on the front panel blinks at a 1-second rate.

FL29 — Channel Change Fault

This fault occurs when a channel change has been attempted, but RF and audio synchronization on the new RF carrier has not been achieved within 5 seconds. Acquisition returns to the previous signal, and normal operation is restored once lock is achieved. The channel change may be initiated from any one of three sources:

- Local FS command;
- FS command from the uplink; and
- Remote (external) channel change (see LC command).

This is an abnormal condition and indicates that there may be a configuration error within the receiver, a mismatch with the actual RF carrier parameters, or that the RF carrier is not present.

FL30 — Control Channel ID Fault

This fault condition exists if the channel and network ID information is not received over the control channel every 5 seconds. Typically, this indicates that a problem exists at the uplink concerning the audio multiplexer. However, if other receivers in the network are not showing this alarm condition, then the unit may need servicing.

FL31 — Invalid Network ID

This fault occurs when the receiver achieves RF sync, but receives an invalid network/channel ID, or no network/channel ID at all. This fault indicates that one or more of the following conditions are true:

Receiver FD or CC commands are not set properly.

The uplink is not transmitting a network/channel ID, or it is transmitting an invalid network/channel ID.

There is a hardware problem with the audio decoder portion of the ABR receiver.

The receiver locked onto an adjacent audio carrier that is within its frequency search range, but it is not the carrier specified in the selected format definition.

Troubleshooting Diagnosis

In addition to the fault indications above, a number of symptoms may indicate problems that can be corrected. These symptoms and actions are described in Table 4.17.

TABLE 4.17, ABR200 TROUBLESHOOTING SYMPTOMS AND ACTIONS

SYMPTOM	ACTION
Power indicator is not illuminated	- Make sure that unit is plugged into an active AC outlet - Verify that the line cord is firmly plugged into the rear panel receptacle - Make sure that the line cord is not at fault by using a cord that is known to be working *Note: If these do not solve the problem, this indicates a possible internal fuse failure. Do not attempt to repair!*
No sign-on message on RS-232 terminal after power up	- Make sure the power indicator is on - Check that the RS-232 cable is connected to the M&C port via the DB-9 to DB-25 adapter cable supplied with the receiver. A "straight-through" connection should be used. Verify the connection between pins 2 and 3 at both ends of the cable. Make sure that pin 4 (data terminal ready) is an active input into the receiver. - Check to see if the terminal is configured properly (default is 2400 baud, 7 data bits, 1 stop bit, odd parity)
Sign-on message is present, but typed commands are not displayed on the remote terminal	- Make sure that the command echo is enabled by typing EE <space> <cr> - Make sure of cable connections

SYMPTOM	ACTION
ODU Fault indicator is illuminated	- This indicates that the LNB at the antenna is not drawing power from the receiver - If more than one receiver is connected together (daisy-chained), this indication is normal for those receivers not directly connected to the LNB. This indicator can be turned off using the OM command. - Make sure that the cable between the antenna and the receiver RF input is connected to the LNB at the antenna and to the RF IN connector at the receiver. - Make sure of the cable connectivity between the two connector ends. Use a multimeter to check for continuity after disconnecting the cable. Examine the connectors for proper assembly. - Replace the LNB. If the problem still persists, recheck cable, and then replace receiver.
RF Sync indicator is not illuminated	- The RF signal is not being received properly. Audio Sync indicator should not be illuminated either. If the Audio Sync indicator is illuminated, the receiver unit needs servicing. - Check to see that the configuration parameters are correct for the application (FD, CC, FS) - Check the AGC level using the AG command. The value should be between 50 and 200 - Recheck installation. Refer to startup problems in *TVRO Installation Guide.*
Audio Sync indicator is not illuminated	- If "RF Sync" indicator is on, then the received signal strength may be too low for operation (that is, the "Signal" indicator is off). Investigate causes of low signal strength. If the "signal" indicator is on, or blinking, then the unit is receiving a good signal level. - Check with the uplink to make sure that the audio encoder unit is functioning properly. If it is, then the receiver may need servicing. If it is not, the problem is at the uplink.
Signal indicator is not illuminated	- This indicates that the received signal strength is below the value set by the Q0 command. If the signal is too weak, the "RF Sync" indicator is on. Check the signal strength using the EB ? command.
IDU Fault indicator is illuminated	- Connect a terminal to the M&C port on the rear panel of the receiver. Use the FL ? command to determine what type of faults are occurring. Follow the action descriptions associated with each type of fault.
IDU Fault indicator is blinking	- A software download attempt has not been successful. The receiver continues to operate out of EPROM memory. Once the software download has been successfully completed, this fault automatically clears.

SYMPTOM	ACTION
RF and Audio Sync indicators are on, but no audio signal is present	- The receiver may not be authorized to output audio. Check the audio status, AS, to make sure that audio operation is permitted. If it is not, check with the uplink operator for audio authorization. - Check to make sure that the audio is not being muted by the M0 and M1 commands. - Make sure that the proper connections are made to the audio output (DB9 male) connector. Use the built-in audio tests (AT command) to generate audio tones. Monitor the audio output at the connector. If no tones are present, the unit may need servicing.
Audio is present, but it is highly distorted	- If the signal level indicator is off, then low signal strength may be the problem. - If not, check external connections to the audio port to make sure that no electrical shorts or intermittent connections are present. - If the output feeds several pieces of equipment, disconnect the equipment and monitor the audio at the connector. If the problem disappears, then a wiring problem to external equipment exists. It may be necessary to operate the external equipment through a distribution amplifier.
Audio is present, but unusually high background noise is also present	- If you are operating in a joint stereo mode, a high background (common mode) noise indicates that there is a phase reversal at the encoder's audio inputs. Recheck the encoder wiring to make sure that the input leads (+) and (-) for both channels are properly connected. - Recheck wiring connections at the output of the receiver to make sure of proper phasing.
Audio is present, but the volume is low	- Make sure that connections are made to both signal polarities (+) and (-). When operating with a single connection, the output level is reduced 6 dB below the output level for balanced operation.
RF and Audio Sync are achieved, but there is no data output	- The receiver may not be authorized to output data. Using the FD command, check the receiver authorization setting for the current format. Make sure that data operation is permitted. If it is not, check with the uplink operator for proper authorization. - Make sure that the proper connections are made to the data port output connector (DB25 female). Make sure that the interconnecting cable is properly wired ("straight-through"). - Make sure that the external DTE equipment and data port setup parameters match (same baud rate, stop characters, parity, etc.). - Use the built-in data test (X1 command) to generate data text to the printer. If data output is still not observed, seek assistance from your system administrator.

SYMPTOM	ACTION
RF and Audio Sync are achieved, but there is no relay closure operation	- Make sure that the CO ? command displays the result "CO XXXXXXXX". If a 1 or 0 appears, then the cue signal from the uplink cannot be processed properly. Enter "CO <space> XXXXXXXX". - The receiver may not be authorized for relay operation. Check the receiver authorization setting using the FD command. Make sure that relay operation is permitted. If it is not, check with the uplink operator for proper authorization. - Make sure that the proper connections are made to the relay/control port connector (DB25 male), and that the interconnecting cable is properly wired. Use the built-in relay test (CO command) to activate and deactivate the relay closures individually. Monitor the contact closure at the connector with a multimeter. This method eliminates any misconnections. If proper operation is still not observed, contact your system administrator.

SCIENTIFIC ATLANTA D9223 Digital Satellite Receiver

Overview

Digital vs. Analog FM Satellite Signal Delivery

The Scientific Atlanta PowerVu Model D9223 Commercial Digital Satellite Receiver tunes digital video, audio, and data signals transmitted over C and Ku-Band satellites. It differs from traditional FM Video receivers in that it receives this information as a compressed, Quadrature Phase Shift Keyed (QPSK) digital signal. This signal compression technique permits the transmission and reception of high-quality, video channels and associated audio per transponder. In comparison, traditional analog FM modulation permits only one video signal (plus associated audio and data) to be transmitted by each transponder.

Because of the increased capacity achieved using digital compression and transmission, special error protection is used to correct errors and provide error concealment when the error rate exceeds the capability of the decoder to provide complete error correction. To detect and correct errors caused by thermal noise, an encoding technique called soft decision convolutional encoding is used. The Model D9223 Receiver and associated uplink equipment use a convolutional encoder to provide error correction to decrease the error rate. To protect against burst noise interference, special data interleave and Reed-Solomon block decoders are used.

Because there may be instances when the error rate is high enough so that not all errors can be corrected, the receiver contains sophisticated software algorithms that provide image concealment for small uncorrected errors, and freeze frame or black-frame substitution for larger uncorrected errors.

The FM analog equivalent to digital errors is the well-known "sparkle" that appears on the TV screen when the received signal level drops below the FM threshold of about 10 dB C/N. Unlike analog transmission, where the "sparkles" are superimposed on the video, uncorrected digital errors can create a loss of digital synchronization, resulting in signal outages that can last longer than the actual duration of the interference. It is during these instances that image concealment is most important. Typically, instead of a single sparkle, a digital error can result in generation of artifacts ranging from "no perceptible error" to "multiple block errors" that appear similar to FM threshold sparkles. For more significant errors, "freeze frames or black screens" may occur.

Receiver Characteristics

The Scientific Atlanta PowerVu Model D9223 Commercial Digital Satellite Receiver is a digital satellite receiver with a built-in MPEG 2 video decompression processor. It is designed to receive and decode/decompress MPEG 1 and MPEG 2 video information streams. The video output detects the line rate of the original video and returns the input to its original PAL or NTSC format. Video and audio are then output to other broadcast equipment for

redistribution. The output can be displayed in either 16x9 (wide aspect ratio) or 4x3 (standard) format.

The Model D9223 receiver is a rack-mounted microcomputer-based unit providing front panel pushbutton operation. A menu system is provided to control viewing of broadcasts.

The variable-rate receiver accepts a compressed RF signal from a C-Band or Ku-Band, low-noise block downconverter (LNB) with a frequency range of 950-2050 MHz. Once tuned to the correct downlink frequency, the frequency plan and virtual channel map are transmitted to the receiver and stored in memory. Virtual channels are then use to select authorized services. The frequency plan is downloaded from the PowerVu Digital Encoder Management Computer (DEMC) at the uplink site upon installation.

The PowerVu receiver is equipped with a MPEG Layer 2 (Musicam) audio decompressor. Audio is output on 600 ohm balanced, Euro-type pluggable connectors. Unbalanced audio outputs are also provided for connection to standard TVs. Output levels for balanced audio channels are adjustable on the rear panel. Four additional mono channels or two stereo channels are available as an option.

The receiver supports NTSC/PAL video outputs, two stereo or four monaural audio channels, video telecast, and error-corrected utility data at data transmission rates up to 38,400 baud. Eight open-collector output signals are also provided for remote control of transmitters, VCRs, or other external devices.

Features

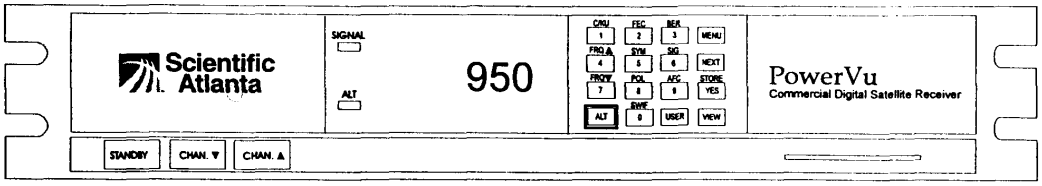
The features included in the Model D9223 receiver are as follows:

- Receives compressed MPEG 2 transport video for decompression in 525-line or 625-line systems. Receives audio which includes data;
- Receives Time Division Multiplex (TDM) or Frequency Division Multiplex (FDM) signals for single or multiple-channel per carrier operation;
- Variable Viterbi Forward Error Correction (FEC) (installer selectable or downloadable over satellite set of 1/2, 2/3,3/4,5/6, or 7/8);
- Variable bandwidth with symbol rates selectable from 1 to 31 Megasymbols/second;
- Multiple video resolution including CCIR-601;
- Virtual channel support;
- Two balanced audio channels (stereo or monaural pairs) are standard. Audio outputs are baseband with rear panel adjustable gain for connection to a cable headend or external modulator. Two additional audio channels (stereo or monaural pair) are available as an option;
- Two unbalanced stereo or four mono audio channels are standard using rear panel mounted RCA connectors;

- Smart card receptacle for enhanced security;
- Homing channel tuning with software downloaded over the air (satellite) or over a remote RS-22 terminal;
- Supports reinsertion of VBI lines 10 to 22 in NTSC fields 1 and 2, or lines 7 to 22 in PAL fields 1 and 2 in appropriate video frame;
- Relay contacts for authorization control and control of external devices;
- An expansion port providing a non-encrypted utility data output at rates up to 38.4 kbps and eight output switches to control external devices. In addition, this port provides the diagnostics and tuning control over a remote serial interface;
- Displays video in 16x9 or 4x3 aspect ratio format with PANSCAN capability; and
- Rack mountable for broadcast and cable headend applications.

See Figure 4.7 for an illustration of the Model D9223 front panel.

Figure 4.7, Scientific Atlanta D9223 Front Panel View



Operations

Front Panel Indicators

The Model D9223 Receiver is simple to operate using the front panel pushbutton switches. The front panel is divided into two sections:

- Power and channel select switches; and
- Mode selection and main keypad pushbutton switches and their associated light-emitting diodes (LEDs).

Operating instructions for the front panel switches are summarized in Table 4.18. For a more detailed description of the keypad functions, go to the *Alternate Mode* section.

TABLE 4.18, FRONT PANEL CONTROL AND INDICATORS

BUTTON/ INDICATOR	FUNCTION
STANDBY	Press STANDBY to select between ON and STANDBY conditions. This button does not control LNB power or power used in the receiver/ authorization circuitry. If AC power is interrupted, the receiver automatically returns to the STANDBY state before interruption. If the receiver was ON before power interruption, it will display the last channel selected when power returns. If the message "FAIL" appears in the display when powering up the receiver, contact your system administrator for assistance.
CHAN. s t	Press CHAN. s or CHAN. t to select Channel mode. The current channel number is displayed while the receiver is in this mode. Press CHAN. s to select the next higher channel available and CHAN. t to select the next lower channel available. The receiver is set to Channel Mode when it is switched on. Channel numbers can also be entered on the main keypad.
SIGNAL	The SIGNAL indicator is on when the receiver is receiving an authorized digital signal. It will flash when receiving an unauthorized digital signal. The indicator will remain off when the receiver is not receiving a digital signal.
ALT	The ALT indicator will flash when the ALT button is pressed once. This indicates that the first level of ALT mode has been selected. When the ALT button is pressed twice in succession, the ALT indicator will remain on. This indicates that the second level of ALT mode has been selected.
ALT Mode Function Keys **ALT**	Press ALT to exit the Menu mode and enter Alternate Mode. Two levels of ALT mode are available. Pressing ALT once will exit the Menu mode and cause the ALT LED to flash, indicating that the first level of ALT mode has been selected. A number of functions can be performed in this mode, such as changing the C/Ku band or L-band frequency. Pressing ALT a second time will cause the ALT LED to stay lighted (steady), indicating that the second level of ALT mode has been selected. At this level, functions such as selecting the Viterbi rate (FEC) or the lock mode may be performed. To exit either level of ALT mode and return to normal viewing (normal operation), press VIEW. To return to the *Commercial Decoder Status Menu* (Main Menu), press MENU. For more information, go to the section on *Alternate Mode*.

BUTTON/ INDICATOR	FUNCTION
C/Ku	Press ALT + 1 to display the broadcast band for downloaded frequency plan. Press 1 again to select between **C** (inverted video) and **U** (noninverted video) band for the frequency plan. This selection affects all channels in the frequency plan. The broadcast band for all channels is set upon installation. For more information, go to the *TVRO Installation Manual*.
FEC	Press ALT + 2 to display or set the FEC (Viterbi) rate for all channels. This value matches the rate displayed on the *Installer Menu* in the range from **1-2** to **7-8**. For more information, go to the section on *Alternate Mode*.
BER	Press ALT + 3 to display the bit error rate (BER) for the selected channel. This value is the same as the value displayed on the *Installer Menu*. As the BER changes, the value displayed is continually updated.
FRQ s t	Press ALT + 4 or 7 to change the L-Band receive frequency for channel 0. The frequency is displayed in MHz units. Use these buttons to increase or decrease the frequency from **950** MHz to **2050** MHz in 250 kHz procedures. The L-Band receive frequency for channel 0 is used for installation. For more information, go to the *TVRO Installation Manual*.
SYM	Press ALT + 5 to display the symbol rate for all channels. The symbol rate is selectable in the range from **1** to **31** Ms/s insteps of 10K symbols/s. Go to the section on *Alternate Mode* for more information.
SIG	Press ALT + 6 to display the signal level of the received signal. The range for the signal level is from **0** to **99**. This value matches the value displayed on the *Installer Menu.*
POL	Press ALT + 8 to display the polarity for the selected channel. Either **H** or **V** will appear in the channel number display. Pressing 8 will switch between the two possible settings.
AGC	Press ALT + 9 to display the tuner offset level of the received signal. The range for this level is from **A-50** to **A+50**. This value matches the value displayed on the *Installer Menu*. As the AGC level changes, this value is continually updated.
SWIF	Press ALT + 0 to monitor the transport data at **SWIF IN** or **RF IN**. You can select either **ON** for **SWIF** or **OFF** for **RF IN** with each press of 0.
Baud	Press ALT + ALT +1 to select the baud rate for the serial remote control pins on the **EXPANSION PORT** connector on the rear panel. The baud rate can be set in the range from **150** to **9600** baud with each press of 1.

BUTTON/ INDICATOR	FUNCTION
PRLY	Press ALT + ALT + 2 to select the remote control output on the rear panel **EXPANSION PORT** connector. This output may be used for external control, for example, for redundancy control through a relay. You can select one of ports **1** to **8** or **OFF** with each press of 2.
LOCK	Press ALT + ALT + 3 to select the lock level. Settings are available from **Loc0** to **Loc4**. For example, **Loc0** indicates that no functions are locked out (all functions are available). **Loc4** indicates that all functions are locked out. Only **Loc0** through **Loc3** may be selected from the front panel. **Loc4** can only be set or disabled from a remote terminal. See the *Lock Levels* section for more information.
ARLY	Press ALT + ALT + 5 to select the operating state of the authorization relay. Select either **ON** of **OFF** with each press of 5. This function controls the state of the **RELAY OUT** terminals on the rear panel. The preset state is **OFF**. When **ON** is selected, the relay follows the authorization state of the virtual channel services. An **ON** state appears as a high at pin 10 of the **EXPANSION PORT** connector (i.e., Low when **OFF** or High when **ON**). A high at pin 10 energizes the relay. When **OFF** is selected, the relay is energized at all times provided power is applied to the receiver.
WIDE	Press ALT + ALT + 6 to select wide picture mode. Select either **4-3** (normal) or **16-9** (wide) with each press of 6.
VID	Press ALT + ALT + 7 to select the video standard. Select one of four settings with each press of 7: **525, 625, 525A, or 625A**.
VBR	Press ALT + ALT + 9 to display the bit rate at which video is received by the receiver. The bit rate can be set in the range from **1** to **15** Mb/s.
STORE	Press YES to save a change made to any setting while in ALT mode. This includes all of the above function settings beginning with C/Ku and ending with VBR. If a different channel is selected or a power interruption occurs before you perform a STORE operation, any changes made to the frequency plan will be lost.
0 to 9	These buttons can be used to enter a channel number directly when in the Channel Mode, or to select a menu when in the Menu Mode. These modes are explained in more detail in the sections to follow.
MENU	Pressing MENU allows you to display and use the *Main Menu* when a TV or monitor is connected to the **MONITOR** output of the receiver. This allows selection of a number of services. See the section on *Menu Functions* for more information.
NEXT	Pressing NEXT allows you to move the pointer (">") to the next item on the *Installer Menu* (in the Menu Mode).

BUTTON/ INDICATOR	FUNCTION
YES	Pressing YES confirms a menu item selection, such as saving selected data. See the section on *Menu Functions* for more information.
VIEW	Pressing VIEW while in any mode will return you to Channel mode. When using the Menu functions, pressing VIEW returns you to the channel you were watching. This button can also be used along with the numerical buttons for selecting a channel. See the section on *Channel Mode* for more information.

Modes of Operation

The Model D9223 receiver is designed to operate in a number of different modes applicable to different functions. For example, to change channels, you must be in Channel mode, to change the L-Band frequency to receive the downloadable frequency plan, you must be in ALT mode, or to view or set installation parameters using a monitor you must be in Menu mode. The different modes of operation are discussed in this section.

Channel Mode

The receiver is automatically set to Channel mode when the unit is powered on. Channel number **0** will be displayed in the window in the front panel of the receiver when the **STANDBY** switch is initially pressed. The various ways to select channels are to:

a) Press the **CHAN.** σ or **CHAN.** τ button to change channels one at a time in the direction pressed.

or

b) Press the individual numerical button and then VIEW.

∫	For channel 9, press 9 then VIEW.

or

c) Press the individual numerical buttons using a 3-digit sequence. This will change the channel instantly.

∫	For channel 9, press 0 0 9.

4	If only one or two numbered buttons are pressed to select a channel, the receiver will automatically switch to that channel after a four-second delay. If you enter a channel number which is outside the range of the frequency plan, the receiver will not change channels.

Menu Mode

Menu mode is used to display three menus:

a) A *Commercial Decoder Status Menu,* which indicates the decoder's operating status.

b) A *Service Menu,* which indicates the services the decoder is authorized to receive.

c) An *Installer Menu,* which is used upon installation to download a frequency plan to the decoder containing preset virtual channel services.

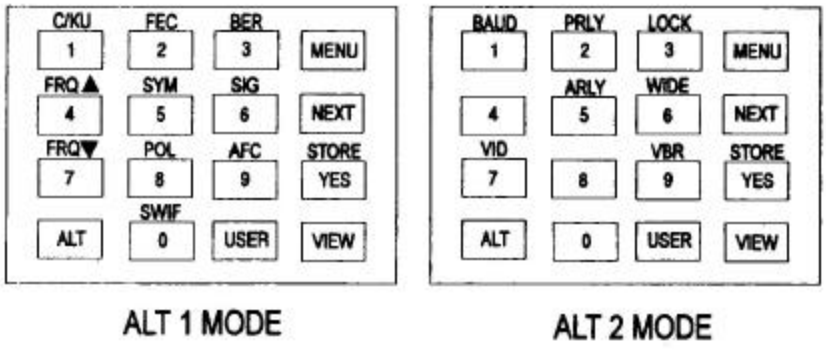
To enter Menu mode, simply press the MENU button. Then to return to normal viewing, press VIEW at any time.

Alternate Mode

Alternate (ALT) mode is used to change the preset installed operating parameters using the front panel keypad and channel number display. If you have a monitor, you may prefer to change the preset parameters using the *Installer Menu*. In this case, refer to the section on the *Installer Menu* for instructions to set up or change these settings using a monitor.

Two levels of ALT mode are available: ALT-1 and ALT-2. The labels above the keys on the front panel inlay show only those functions that can be performed in ALT-1 mode. This section describes all the functions that can be performed in both ALT modes. Figure 4.8 below shows the various functional definitions assigned to each key on the keypad for both modes of operation.

Figure 4.8, Keypad Functional Definitions for Both Operational Modes

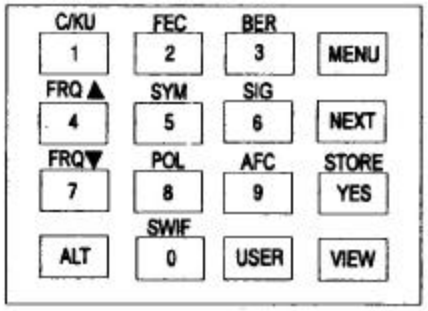


ALT-1 Mode

Pressing ALT once from either the normal viewing mode or Menu mode, will cause the ALT LED to flash, indicating the first level of ALT mode (i.e., ALT-1) has been selected.

In ALT-1 mode, the functions labeled above the buttons on the keypad identify their use as shown in Figure 4.9 below:

Figure 4.9, ALT-1 Mode Keypad Functions



ALT 1 MODE

The functions that can be performed in ALT-1 mode are as follows:

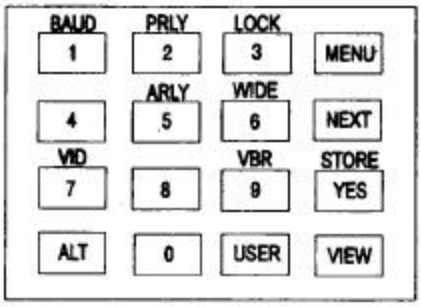
- select the C/Ku band setting;
- select the FEC rate;
- display the bit error rate;
- increase the L-Band frequency;
- select the symbol rate;
- display the signal level;
- decrease the L-Band frequency;
- display the signal polarization;
- display the AFC level;
- select the SWIF setting; and
- store your changes.

ALT-2 Mode

Pressing ALT + ALT from either the normal viewing mode or Menu mode, will force the ALT LED to remain on, indicating the second level of ALT mode (ALT-2) has been selected.

In this mode, the labels above the buttons are ignored, except for STORE. Figure 4.10 illustrating the labeled functions that can be performed in this mode is shown below:

Figure 4.10, ALT-2 Mode Keypad Functions



ALT 2 MODE

The functions that can be performed in ALT-2 mode are as follows:

- select the baud rate for the serial remote control port;
- select the state of the remote control port relay;
- select the lock mode;
- select the state of the authorization relay;
- select normal or wide picture display;
- select the video standard (e.g., 525 or 625);
- display the video bit rate; and
- store your changes.

4	To change any of the settings in ALT-1 orALT-2 modes, you must store the settings by pressing the **STORE** button. All parameters that can be changed are saved when the **STORE** button is pressed (regardless of whether any have been changed). It is easier to change all the required parameters and then store them when finished.

ALT Mode Quick Reference

The parameters that can be displayed in ALT-1 and ALT-2 modes are tabulated in Table 4.19 for ease of reference. Pressing the button that corresponds to the parameter in the first column will display the setting for that parameter.

Examples:

1. Press **1** while in ALT-1 mode to display the C/Ku band setting.
2. Press **1** while in ALT-2 mode to display the baud rate for the serial remote control port.

TABLE 4.19, ALT-1 AND ALT-2 MODE PARAMETERS

PARAMETERS	ALT-1 MODE ALT	ALT-2 MODE ALT + ALT
C/KU Band	1	
FEC Rate (FEC)	2	
Bit Error Rate (BER)	3	
FRQ ó	4	
Symbol Rate (SYM)	5	
Signal level (SIG)	6	
FRQ ò	7	
Polarity (POL)	8	
AFC	9	
Input Selection (SWIF)	0	
Baud Rate (BAUD)		1
Remote Control Port Relay (PRLY)		2
Lock Setting		3
Authorization Mode Relay (ARLY)		5
Normal/Wide Picture (WIDE)		6
Video Standard (VID)		7
Video Bit Rate (VBR)		9
Store	YES	YES

Front Panel Functions

Each of the parameters that can be set in both ALT-1 and ALT-2 modes, and the method for setting each parameter individually are described in this section, step-by-step.

ALT-1 MODE

Changing the C/Ku Band Setting

To change the **C/Ku** band setting you must be in ALT-1 mode. To select ALT-1 mode and change this setting, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 1. "C" (for C Band) will normally be displayed in the channel number display. This is the preset setting.
3. Press 1 again if you need to change the setting to U for Ku band. This selection affects all the channels in the frequency plan.
4. Press YES (STORE) to save the new setting, or press VIEW to abandon changes and return to normal viewing.

Changing the FEC Rate

To change the FEC rate you must be in ALT-1 mode. To select ALT-1 mode and change this setting, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 2. **"7-8"** will normally be displayed in the channel number display. This is the preset setting.
3. Press 2 again if you need to change the setting to **1-2, 2-3, 3-4, 5-6** or **7-8** for the received signal. This selection affects all the channels in the frequency plan.
4. Press YES (STORE) to save the new setting, or press VIEW to abandon changes and return to normal viewing.

Displaying the Bit Error Rate

To display the bit error rate (BER) you must be in ALT-1 mode. To select ALT-2 mode and display the BER, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 3 to display the Bit Error Rate (BER). The BER provides an indication of the signal quality. It is dependent upon atmospheric conditions and the amount of signal fade.
3. The BER will be displayed in the range from **0.0-6** (ideal) to **6.5-2** (worst), which means 0.0E-6 to 6.5E-2. The normal operating range is typically from **1.0-5** to **1.0-3**.

Changing the L-Band Frequency

To change the L-Band downlink video frequency, you must be in ALT-1 mode. To select ALT-1 mode and change this setting, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 4 or 7. This will display the default L-Band frequency. The preset frequency setting is displayed in MHz units.
3. Press 4 to increase the frequency, or 7 to decrease the frequency to the value you want in the range from **950** MHz to **2050** MHz in 250 kHz steps. Pressing 4 or 7 four times will increase or decrease the setting by 1 MHz. Holding the button down will rapidly increase or decrease the frequency in the direction required.
4. Press YES (STORE) to save the new setting, or press VIEW to abandon changes and return to normal viewing.

Changing the Symbol Rate

To select the symbol rate, you must be in ALT-1 mode. To select ALT-1 mode and display this setting, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 5. This will display the symbol rate setting. The default symbol rate setting is **28.34** Megasymbols/second (Ms/s).
3. Press 5 repeatedly to increase the symbol rate in 10K symbols/second steps, or press and hold 5 to rapidly increase the number to the one you want in the range from 1 to 31 Ms/s.
4. Press YES (STORE) to save the new setting, or press VIEW to abandon changes and return to normal viewing.

Displaying the Signal Level

To display the received signal level you must be in ALT-1 mode. To select ALT-1 mode and display the signal level, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 6 to display the signal level. The displayed level indicates the relative level of the received signal in the range from **0** to **99.** Typically, the number displayed should be between 50 and 80 for an input signal of -50 dBm. A signal level at either end of the range (near 0 or 99) will be evident by poor picture quality. This level is useful for antenna peaking.

Changing the Signal Polarity

To change the polarity of the selected channel you must be in ALT-1 mode. To select ALT-1 mode and change this setting, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 8 to display the polarity of the received signal. **"H"** or **"V"** will be displayed in the channel number display.
3. Press **CHAN.** σ or **CHAN.** τ to change the polarity to the required setting.

Displaying the AFC Level

To display the AFC level you must be in ALT-1 mode. To select ALT-1 mode and display the AFC level, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 9 to display the AFC level. This setting indicates the amount of LNB drift present in the received signal. The level displayed will be in the range from **A-50 to A+50.** The normal operating range is typically between **A-10** and **A+10**.

Selecting the SWIF Input

To select the SWIF input you must be in ALT-1 mode. To select ALT-1 mode and select or change this setting, follow the steps below:

1. Press ALT once and check that the ALT LED flashes. This indicates that you are in ALT-1 mode.
2. Press 0 to display the input setting. This setting is used to select whether the SWIF input is to be derived from the SWIF input or RF input (L-band input). **"OFF"** will normally be displayed in the channel number display. This means the receiver is preset to select the SWIF input from the signal received at the **RF IN** connector.
3. Press 0 to select the input you want as follows:

   Select **On** to select the signal received at **SWIF IN** or **OFF** for the signal at **RF IN**. These options are tabulated as follows:

FRONT PANEL SETTING	SELECTS SWIF INPUT FROM
On	SWIF IN
OFF	RF IN

5. Press YES (STORE) to save the new setting, or press VIEW to abandon changes and return to normal viewing.

ALT-2 MODE

Changing the Baud Rate of the Serial Remote Control Port

To change the baud rate of the serial remote control port pins on the **EXPANSION PORT** connector on the rear panel you must be in ALT-2 mode. To select ALT-2 mode and change this setting, follow the steps below:

1. Press ALT twice and check that the ALT LED remains on. This indicates that you are in ALT-2 mode.
2. Press 1 to display the baud rate. **"9600"** will normally be displayed in the channel number display. This is the preset baud rate setting. It is recommended that you leave this parameter set to **"9600"** for the quickest transmission rate unless you have been instructed to change it by your system administrator.

   Seven settings are available: 150, 300, 600, 1200, 2400, 4800 and 9600.
3. If you have been instructed to change this setting, press 1 until the setting you want is displayed.

Changing the Remote Control Port Relay Setting

To change the remote control port connection on the **EXPANSION PORT** connector on the rear panel you must be in ALT-2 mode. To select ALT-2 mode and change this setting, follow the steps below:

1. Press ALT twice and check that the ALT LED remains on. This indicates that you are in ALT-2 mode.
2. Press 2 to display the port that is enabled. **"OFF"** will normally be displayed in the channel number display. This is the preset state. It is recommended that you leave this parameter set to **"OFF"** unless you intend to connect equipment to one of the remote control ports at the **EXPANSION PORT** connector.

   Nine settings are available: **1** to **8** and **OFF**.
3. If you have been instructed to change this setting, press 2 until the setting you want is displayed. The pinout for the **EXPANSION PORT** connector showing the pins for each remote control port can be found in the section *Output Connector Configurations* in the *TVRO Installation Guide*.

Changing the Lock Level

To change the lock level from one mode to another, you must be in ALT-2 mode. Place the receiver in this mode and change the lock level as follows:

1. Press ALT twice to enter ALT-2 mode. The front panel ALT LED will remain on to indicate selection of this mode.
2. Press 3 to display the currently selected lock level (the default setting is **Loc0**).

4	If **Loc4** is displayed, the lock setting can only be changed using a remote terminal. **Loc4** locks out all front panel functions including the lock change feature for security reasons. In this case, the front panel cannot be used to unlock or change the lock mode. Contact your system administrator for assistance.

3. If you have been instructed by your system administrator to change the lock level in order to view and/or change certain operating parameters, press 3 again to change the display to the level you want (i.e., **Loc1, Loc2,** or **Loc3**). Certain restrictions apply in each lock mode. Refer to the section on *Lock Levels* for more information.

4	It is not necessary to press YES to save the lock setting as any change in the lock level is saved automatically when you exit ALT mode.

To exit ALT mode and return to Channel mode, press ALT again or VIEW.

Changing the Authorization Relay Operating State

To select and change the mode of operation of the authorization relay (**RELAY OUT**) on the rear panel you must be in ALT-2 mode. To select ALT-2 mode and change this setting, follow the steps below:

1. Press ALT twice and check that the ALT LED remains on. This indicates that you are in ALT-2 mode.

2. Press 5 to display the mode of operation. **"OFF"** will normally be displayed in the channel number display. This is the preset mode of operation. If you connect equipment to these terminals to switch to redundant backup, or other equipment in the event of loss of authorization, pin 10 of the **EXPANSION PORT** connector will track the operating state of the **AUTH** terminals, because they are connected to the same control port internally.
3. If you have been instructed to change this setting, press 5 until the setting you want is displayed.
4. Press YES (STORE) to save the new setting, or press VIEW to abandon changes and return to normal viewing.

Changing the Aspect Ratio

To change the aspect ratio you must be in ALT-2 mode. To select ALT-2 mode and change this setting, follow the steps below:

1. Press ALT twice and check that the ALT LED remains on. This indicates that you are in ALT-2 mode.
2. Press 6 to display the preset aspect ratio for programs to be viewed on your TV set or monitor. The preset setting is **4-3** (4x3 aspect ratio) for normal viewing format.
3. If you have a wide aspect ratio TV, press 6 again to change the setting to **16-9** to set your receiver to view programs broadcast in 16x9 format.

4	The 16-9 setting will only be available in the decoder if the corresponding parameter is set at the uplink.

4. Press YES (STORE) to save the new setting, or press VIEW to abandon changes and return to normal viewing.

Changing the Video Standard

To change the video standard you must be in ALT-2 mode. To select ALT-2 mode and set or change this setting, follow the steps below:

1. Press ALT twice and check that the ALT LED remains on. This indicates that you are in ALT-2 mode.
2. Press 7 to display the video standard setting. This setting is used to initially define the video output. **"525A"** will normally be displayed in the channel number display. This is the preset video standard setting. The recommended settings are: **525A** for 525-line systems and **625A** for 625-line systems.
3. Press 7 until the setting you want is displayed. The following settings are available:
   - **525** - 525-line standard;
   - **625** - 625-line standard;
   - **525A** - automatically switches from 525 to 625-line standard; and

- **625A** - automatically switches from 625 to 525-line standard.

Displaying the Video Bit Rate

To display the video bit rate you must be in ALT-2 mode. To select ALT-2 mode and display the video bit rate, follow the steps below:

1. Press ALT twice and check that the ALT LED remains on. This indicates that you are in ALT-2 mode.
2. Press 9 to display the video bit rate. This setting indicates the video transmission rate set at the uplink for the virtual channel. The level displayed will be in the range from **1** to **15** Mb/s.

4	If no signal is present, a video bit rate of 0.00 will be displayed on the front panel.

Lock Levels

Under normal operating conditions, all front panel buttons should be locked out to prevent unauthorized tampering with the unit. However, four levels of front panel lock-out are available on the Model D9223 Receiver to enable you to customize your lock level setting (that is, to allow view only or all parameters to be changed). Refer to Table 4.20 to determine the functions available at each lock level.

TABLE 4.20, ENABLED PARAMETERS AT EACH LOCK LEVEL

ENABLED PARAMETER	LOC0	LOC1	LOC2	LOC3	LOC4
ON/STANDBY	•	•	•		
CHAN. ⇧ CHAN. ⇩, HELP	•	•			
C/KU selection	•	•			
FEC rate selection	•	•			
FRQ ⇧, FRQ ⇩	•	•			
Symbol rate selection	•	•			
Polarity selection	•	•			
SWIF input selection	•	•			
Serial remote control baud rate selection	•	•	•		
Remote control port relay selection	•	•	•		
Lock mode selection	•	•	•	•	
Authorization relay state selection	•	•	•		
Normal/Wide picture selection	•	•			
Video standard selection	•	•			
Installer menu	•	•			
MENU	•	•	•		
Direct channel entry via keypad	•	•			

ENABLED PARAMETER	LOC0	LOC1	LOC2	LOC3	LOC4
Factory channel reinitialization	•				

The front panel can be used to set lock levels up to **Loc3**. **Loc3** locks out all front panel buttons allowing the operator to view, but not change any parameters. This prevents anyone from accidentally changing the operating parameters of the decoder.

Loc4 can only be set using a remote terminal. **Loc4** does not allow the user to view or change any parameters. To set or change the lock level, refer to the section on *Changing the Lock Level.*

4	All parameters that display only, such as Bit Error Rate, Signal Level, and Video Bit Rate, can display at all lock level settings except **Loc4.**

Factory Channel Reinitialization

The default factory settings can be restored by performing the following procedure:

1. Press ALT.
2. Press the **CHAN.** σ and **CHAN.** τ buttons simultaneously.
3. When **"do?"** appears in the channel number display, press YES (STORE). The word **"CLR"** will appear in the display for approximately 20 seconds, followed by **"Init"**. The receiver will then power off, indicated by a dot, "**.**", in the channel number display.

When the receiver is reinitialized, default factory settings appear in the front panel display for the parameters in Table 4.21 below:

TABLE 4.21, FACTORY DEFAULT PARAMETER SETTINGS

PARAMETER	DEFAULT SETTING
Virtual Channel	0
Band (C/Ku)	C
L-Band Frequency	950.00 MHz
FEC Rate (FEC)	7-8
Symbol Rate (SYM)	28.3465 Mb/s
Video Standard (VID)	525A
Polarization (POL)	H
Input Select (SWIF)	RF
Seconds to No Signal	5
RC8 Relay State (PRLY)	OFF
AUTH Relay (ARLY)	OFF
Remote Serial Interface	9600
Aspect Ratio	3-4

This completes the reinitialization procedure. Any violation of this procedure will abort the reinitialization and the receiver will return to Channel mode. If the receiver does not perform as described above, a malfunction exists. In this case, contact your distributor.

Once reinitialization is complete, refer to the *Installer Menu* under *Menu Functions* to change any of these settings for normal operation of your receiver.

Menu Functions

The Model D9223 receiver displays three menus:

a) A *Commercial Decoder Status, menu* which indicates the decoder' s operating status.

b) A *Service Menu,* which indicates the services the decoder is authorized to receive.

c) An *Installer Menu,* which is used upon installation to download a frequency plan to the decoder containing preset virtual channel services.

4	The Menu system is locked out when the lock level is set to **Loc2**, **Loc3** or **Loc4**. In this case, when you press the MENU button to display the first menu – the Commercial Installer Menu – the message **"Loc2"**, **"Loc3"**, or **"Loc4"** is displayed in the front panel channel number display. Refer to the section on Changing the Lock Level for instructions to unlock the Menu system.

In Menu mode, the functions of all the front panel buttons change except VIEW, MENU, ALT and **STANDBY**.

Commercial Decoder Status Menu

To access the *Commercial Decoder Status menu,* which is the main menu, follow the steps below:

1. Press the MENU button on the front panel keypad to display the *Commercial Decoder Status menu*.
2. Then to unlock the *Installer Menu,* press 2.
3. The line *"Press 2 to unlock Install"* displayed at the bottom of the screen will then change to *"Press 9 for Installer Menu"*.

4	The Installer Menu system is locked out when the lock level is set to **Loc1, Loc2, Loc3** or **Loc4.** In this case, when you press 2 to unlock the Installer Menu, the message **"Loc1", "Loc2", "Loc3"** or **"Loc4"** is displayed in the front panel channel number display depending on the lock level previously set. Refer to the section on *Changing the Lock Level* for instructions to change the lock level.

4. Press 9 to display the *Installer Menu*.

You can then access the *Installer Menu* to set up the homing channel to receive the downloadable virtual channel services for your decoder. See the section on the *Installer Menu* for setup instructions.

The screen below shows a typical *Commercial Decoder Status menu*. This menu is for display purposes only and is helpful for system troubleshooting.

```
                COMMERCIAL DECODER STATUS
Decoder Address      000-000-4107-8
Decoder Versions     1.00/1.02(2)
SmartCard            Not Installed
SmartCard Version    N/A
Additional Versions  1.12/1.01
ADP enc.             20 of 20 rec'd
ADP non-enc.         18 of 18 rec'd

Bit Error Rate:      1.OE-5   LOCKED
Signal Level:        60
AFC Level:           0

Press 0 to Display Services
Press 1 to clear ADP
Press 2 to unlock Install
Press VIEW to watch TV
```

You can exit the *Commercial Decoder Status menu* and return to the channel you were previously viewing at any time by pressing VIEW.

Menu Definitions

Decoder Address

This field displays the 11-digit serial number identifying the receiver.

Decoder Versions

This field displays the decoder version numbers of the DCP and ISE devices within the decoder. The number in ( ) indicates the algorithm code. This algorithm is specific for your network.

SmartCard

This field indicates whether a smart card is **Installed** or **Not Installed.** If a smart card is installed, this field will display the smart card ID in the same format as the Decoder Address field.

SmartCard Version

This field indicates the SmartCard version number when the smart card is installed.

Additional Versions

This field indicates the version numbers of the KBD and CCP devices within the receiver, respectively.

ADP enc.

This field indicates whether the encrypted ADPs (Addressed Data Packets) received by the DCP within the receiver have been properly processed. Both numbers in this field should be identical, as shown on the *Commercial Decoder Status menu* on the previous page.

To clear the value in this field, press **1**.

ADP non-enc.

This field indicates whether the non-encrypted ADPs received by the ISE (Inboard Security Element) in the receiver have been properly processed. Both numbers in this field should be identical as shown on the *Commercial Decoder Status menu.*

To clear the value in this field, press **1**.

Bit Error Rate

This field indicates the bit error rate (BER) of the received signal. The BER provides an indication of the signal quality. It is dependent upon atmospheric conditions and the amount of signal fade.

The BER will be displayed in the range from **0.0E-6** (ideal) to **6.5E-2** (worst). The normal operating range is typically from **1.0E-5** to **1.0E-3**.

Locked Message: **"LOCKED"** is displayed to the right of this field when the receiver is locked to an RF input signal.

Search Message: **"SEARCH"** is displayed to the right of this field when the receiver has lost signal is searching for the carrier.

Signal Level

This field indicates the relative level of the received signal. The number displayed may vary from a minimum signal strength of **0** to a maximum of **99.** Typically, the number should be between 50 and 80 for an input signal level of

minus 50 dBm. A signal level at either end of the range (near 0 or 99) will be evident by poor picture quality. This level is useful for antenna peaking.

No Signal Message: **"No Signal"** is displayed to the right of this field when the signal level is very low. This may indicate that the input signal cable is faulty.

AFC Level

This field indicates the amount of LNB drift present in the received signal. The level displayed will be in the range from **-50** to **+50**, with the normal operating range typically between **-10** and **+10**.

Service Menu

The *Service Menu* is accessed by pressing **0** on the *Commercial Decoder Status menu*. This menu displays the services that the receiver is authorized to receive.

You can exit this menu and return to the channel you were previously viewing at any time by pressing VIEW. All the front panel buttons function while this menu is displayed.

The screen below shows a typical *Service Menu*. This menu is for display purposes only and is helpful for system troubleshooting.

```
Program: 0          SERVICE MENU

Services are AUTH with ENC on
 Video:                    ON      ( 4096)
 Audio1:                   ON      ( 4097)
 Audio2:                   ON      ( 4097)
 Audio3:                   ON      (    0)
 Audio4:                   OFF     (    0)
 Utility:                  ON      ( 4099)
 High Speed:               ON      ( 2056)
 VBI:                      OFF     (    0)
 Dnld:          DCP:       OFF     ( 5004)
                CCP:       OFF     ( 5005)
 Transport ID:                     (11000)
 PMT PID:                             3111
 PCR PID:                             2444
 Port. 00                       1150.00 MHz

 Press VIEW to watch TV
 Press MENU for Main Menu
```

Menu Definitions

Services are AUTH with ENC on

This field displays the current status of the services received from the uplink encoder. It may be in one of the following states:

- Services are AUTH with ENC on;

- Services are AUTH with ENC off;
- Services are NOT AUTH with ENC on; and
- Services are MUTED with NoSig.

4	1. AUTH means "AUTHorized" 2. ENC means "ENCryption"

Video

This field displays whether video is **ON** or **OFF**, and the PID assignment for the service in ( ). The PID is assigned at the uplink in the range from **32** to **8095**.

A number of video streams are transmitted as part of the multiplexed signal. These services are mapped at the uplink encoder. Each service represents a particular multiplex configuration at the encoder.

Audio1, Audio2, Audio3, Audio4

These fields display whether the respective audio service is **ON** or **OFF**, and the PID assignment for the service in ( ). Each PID is assigned at the uplink in the range from **32** to **8095**.

Two-channel audio is provided as a standard feature on the receiver; with four-channel audio available as an option.

Utility

This field displays whether the utility data service is **ON** or **OFF**, and the PID assignment for the service in ( ). The PID is assigned at the uplink in the range from **32** to **8095**. Utility data can be output at rates up to 38,400 baud.

High Speed

This field displays whether the high-speed RS-422 synchronous data service is **ON** or **OFF**, and the PID assignment for the service in ( ). The PID is assigned at the uplink in the range from **32** to **8095**.

VBI

This field displays whether the vertical blanking interval service is **ON** or **OFF**, and the PID assignment for the service in ( ). The PID is assigned at the uplink in the range from **32** to **8095**.

Dnld: DCP, CCP

The DCP and CCP fields display whether the transport stream contains DCP and CCP download information. These fields are in the **ON** state when the transport stream contains this information and **OFF** when the information is not being transmitted.

The PID assignment for the DCP and CCP software version is also displayed in the ( ) to the right of the state field. Each PID is assigned at the uplink in the range from **32** to **8095** (for example, 5004, 5005, etc.) for each downloadable parameter.

Transport ID

Each network is assigned one transport stream ID in the range from **0** to **65535** to transmit video, audio and data services. This field displays the network's transport stream ID used to transmit virtual channel services to your decoder.

PMT PID

This field indicates the Program Map Table (PMT) PID for the selected virtual channel assigned at the uplink. The PMT PID is assigned at the uplink in the range from **32** to **8095**.

PCR PID

This field indicates the Program Clock Reference (PCR) PID. It is used to lock the video, audio and data services in the transport stream for transmission to decoders. The PCR PID is assigned at the uplink in the range from **32** to **8095**.

Port

This field displays the (Expansion Port) remote control output pin settings transmitted by the uplink encoder, in hexadecimal numbers. This port can be used for a number of different applications, such as switching a VCR or transmitter on and off.

Installer Menu

The *Installer Menu* is accessed by pressing 2 on the *Commercial Decoder Status menu*, which unlocks the *Installer Menu*, and then 9 to display the *Installer Menu*.

4	The channel changes to channel "0" when selecting this menu. Channel 0 is called the homing channel. As a result, video will be momentarily interrupted when selecting this menu.

The *Installer Menu* consists of two pages of selectable settings. This two-page menu allows installation personnel to set the transponder frequency and other decoder-specific parameters to download a preset frequency plan to your decoder. This frequency plan contains all the virtual channel services that your decoder is authorized to receive.

You can exit this menu at any time by pressing VIEW.

The screen below shows an example of the first page (page 1/2) of an *Installer Menu* set to receive the downloadable frequency plan from the uplink encoder (with the preset settings).

Installer Menu Page 1 of 2

```
                    Installer Menu                    1/2
> Band:             C/L-Band Freq.
  L-Band Freq.:     950.00          (MHz)
  FEC Rate:         7/8
  Symbol Rate       28.3465         (MS/s)
  Polarization:     H
  Input Select:     RF


  Bit Error Rate:   1.OE-5          LOCKED
  Signal Level:     60
  AFC Level:        0

Press CHAN. UP/DN to modify
Press NEXT to select
Press YES to store all data
Press USER to select page 2
```

Menu Definitions

The menu items at the top of each page of the *Installer Menu* must be set to enable your decoder to receive preset authorized services.

The Bit Error Rate, Signal Level and AFC Level menu items are displayed for troubleshooting purposes only. They are indicative of the input signal level and provide information about the signal quality. This information is helpful in the event that you experience a poor signal.

Band

This field is used to set the video band for the homing channel (channel 0) to download the frequency plan. The selection affects all virtual channels in the frequency plan.

This field is preset to **C**. To change the homing channel Band, proceed as follows:

1. Press the NEXT button to move the ">" to *Band*.
2. Press **CHAN.** ↓ or **CHAN.** ↑ until the band that you want is displayed. The following selections are available:
   - C/L-Band Freq.;
   - C/Downlink Freq.;
   - Low Ku/L-Band Freq.;
   - High Ku/L-Band Freq.;
   - Single Ku/Downlink Freq.; and
   - Dual Ku/Downlink Freq.

L-Band/Downlink Freq.

This field is used to set either the L-Band or downlink frequency for the homing channel (channel 0) for the receiver to download the frequency plan. It is preset to a default frequency in MHz units when an L-Band frequency setting is selected (for example, C/L-Band Freq.) in the *Band* field or GHz when a downlink frequency setting is selected (for example, Single Ku/Downlink Freq). The default settings are given in Table 4.22 for each of the available *Band* settings:

TABLE 4.22, DEFAULT FREQUENCY SETTINGS

BAND	FREQUENCY SETTING
C/L-Band Freq.	950.00 MHz
C/Downlink Freq.	4.20000 GHz
Low Ku/L-Band Freq.	950.00 MHz
High Ku/L-Band Freq.	950.00 MHz
Single Ku/Downlink Freq.	10.70000 GHz
Dual Ku/Downlink Freq.	10.70000 GHz

To set the homing channel frequency, proceed as follows:

1. Use the NEXT button to move the pointer (">") to *L-Band Frequency*.

   The first line at the bottom of the screen will change to:

   PRESS CHAN UP/DN to modify or use direct entry

6. Use the number buttons (0 to 9) to directly enter the frequency, or press and hold **CHAN.** σ or **CHAN.** τ to increment or decrement the frequency until you reach the desired setting. For direct channel entry, see the following example:

∫	To enter 1250 MHz, press 1 2 5 0 0 0. The display in the first field will then appear as **1250.00**. If you make a mistake, just enter the numbers again.

If you enter a number outside of the range of 950 to 2050 when an L-Band frequency setting is selected, the display will change to the nearest number.

∫	If you enter 900, the display will default to 950.00. In this case, just enter the correct numbers again.

FEC Rate

This field is used to set the Viterbi (FEC) rate which is the inner rate of the Viterbi error corrector. It is normally preset to **7/8**. It is recommended that you leave this parameter set to "3/4" unless you have been instructed to change it by your system administrator.

Five settings are available: **1/2, 2/3, 3/4, 5/6** and **7/8**.

If you need to change the Viterbi rate, proceed as follows:

1. Press the NEXT button to move the ">" to *Rate*.
2. Press **CHAN.** σ or **CHAN.** τ until the Viterbi rate you want is displayed: **1/2, 2/3, 3/4, 5/6**, or **7/8**.

Symbol Rate

This field is used to initially set the symbol rate of the transmitted signal. The symbol rate is a value between 1 and 31 in Megasymbols/second (Ms/s). It is preset to **28.3465**. If you need to change this setting, proceed as follows:

1. Press the NEXT button to move the ">" to *Symbol Rate*.
2. Use the number buttons (0 to 9) to directly enter the symbol rate, or press and hold **CHAN.** σ or **CHAN.** τ to increment or decrement the frequency in steps of 100 symbols/second until you reach the desired setting. For direct channel entry, see the following example:

∫	To enter 11.000, press 1 1 0 0 0. The numbers that you enter will overwrite the display from right to left. If you make a mistake, just enter the numbers again.

If you enter a number outside of the range of 1 to 31, the display will change to the nearest number.

∫	If you enter 33, the display will default to 31. In this case, just enter the correct numbers again.

Input Select

This field is used to select whether the SWIF input is to be derived (selected) from the SWIF input or RF input (L-band input). It is preset to **RF**. Typically, the SWIF input is used to connect to the SWIF output of a Digital Multiplexer or Digital Encoder for monitoring purposes.

If you need to change this setting, proceed as follows:

1. Press the NEXT button to move the ">" to *Input Select*.
2. Press **CHAN.** σ or **CHAN.** τ to select either **RF** or **SWIF**. Select **SWIF** to receive the transport data input at **SWIF IN** or **RF** to receive the transport data at **RF IN**.

Polarization

This field is used to set the polarization of the homing channel. It is preset to **H**.

If you need to change the setting, proceed as follows:

1. Press the NEXT button to move the ">" to *Polarization.*
2. Press **CHAN.** σ or **CHAN.** τ to change the setting to **V**.

Bit Error Rate

The Bit Error Rate field indicates the bit error rate (BER) of the received signal. The BER provides an indication of the signal quality. It is dependent upon atmospheric conditions and the amount of signal fade.

The BER will be displayed in the range from **0.0E-6** (ideal) to **6.5E-2** (worst). The normal operating range is typically from **1.0E-5** to **1.0E-3**.

Locked Message: **"LOCKED"** will be displayed to the right of this field when the receiver is locked to an RF input signal.

Search Message: **"SEARCH"** is displayed to the right of this field when the receiver has lost signal is searching for the carrier.

Signal Level

This field indicates the relative level of the received signal. The number displayed can vary from **0** to a maximum of **99.** Typically, the number displayed should be between 50 and 80 for an input signal of -50 dBm. A signal level at either end of the range (near 0 or 99) will be evident by poor picture quality.

No Signal Message: **"No Signal"** will be displayed to the right of this field when the signal level is very low. This may indicate that the input signal cable is faulty.

AFC Level

This field indicates the amount of LNB drift present in the received signal. The level displayed will be in the range from **-50** to **+50**. The normal operating range is typically between **-10** and **+10**.

Installer Menu Page 2 of 2

```
                Installer Menu                    2/2

Seconds to No Signal:      5
Network ID:                0
Bouquet ID:                65535
Video Standard: 525A.NTSC->PAL/B
Search/Find Mode           N/A
MPEG Output:               Unfiltered
C Band LO:                 5.150     (GHz)
Ku Low/Single LO:          9.750     (GHz)
Ku High Band LO:           10.600    (GHz)
Ku Band Switch:            11.700    (GHz)

Press CHAN UP/DN to modify
Press NEXT to select
Press YES to store all data
Press USER to select page 1
```

Seconds to No Signal

This field is used to set the interval of time (in seconds) between the moment a loss of signal occurs and the **"No Signal"** message is displayed on the TV or monitor. It is preset to **5** seconds.

If you need to change this setting, proceed as follows:

1. Press the NEXT button to move the ">" to *Seconds To No Signal*.
2. Press **CHAN.** σ or **CHAN.** τ until the setting you want is displayed in the range from **0** to **30**. You can also enter the number directly using the keypad.

Network ID

This field is used to set the network identifier for your uplink. It is preset to **0**. Contact your uplink site to obtain your Network ID in the range from **0** to **65535**.

If you need to change this setting, proceed as follows:

1. Press the NEXT button to move the ">" to *Network ID*.
2. Press **CHAN.** σ or **CHAN.** τ until the setting you want is displayed in the range from **0** to **65535**. You can also enter the number on the keypad.

Bouquet ID

This field is not currently used.

Video Standard

This field is used to set the video standard for the output of the receiver. It is preset to **525A:NTSC->PALB**. If you need to change this setting, proceed as follows:

1. Press the NEXT button to move the ">" to *Video Standard*.
2. Press **CHAN.** σ or **CHAN.** τ until the video standard you want is displayed. Choose the correct setting from the following:
   - 525:NTSC;
   - 525A:PAL/M->PAL/N;
   - 625:PAL/B; and
   - 625A:PAL/B->NTSC.

525 and **625** are fixed video standard settings, while **525A** and **625A** automatically force (switch) the receiver to output video according to the video standard setting.

∫	**625A:PAL/B->NTSC** means PAL/B is the preset video standard, but will automatically switch to NTSC when a NTSC signal is detected.

Search/Find Mode

This field is currently not used. The feature will be available in future.

MPEG Output

This field is used to set whether the SWIF output signal is to be filtered or unfiltered. **Unfiltered** means all the PIDs (program identifiers) received by the variable rate receiver are output as part of the signal, while **Filtered** means only those PIDs assigned to the virtual channel are output as part of the signal.

C Band LO

This field is used to set the C-Band local oscillator (LO) frequency in a C-Band system (for example, when the *Band* setting is either C/L-Band Freq. or C/Downlink Freq). The default setting is **5.150 GHz** when the unit is installed.

To change this setting, press **CHAN.** σ or **CHAN.** τ until the setting you want is displayed or directly enter the number using the keypad.

Ku Low/Single LO

This field is used to set the Ku low-band local oscillator frequency (in GHz) in a single LNB Ku-Band system (for example, when the *Band* setting is either Low Ku/L-Band Freq, Single Ku/Downlink Freq, or Dual Ku/Downlink Freq). The default setting is **9.75 GHz**.

4	Some LNBs are set to receive a Ku band signal at 10.75 GHz. Check this setting if the receiver does not lock onto a signal at 9.75 GHz.

To change this setting, press **CHAN.** σ or **CHAN.** τ until the frequency setting you want is displayed or directly enter the number using the keypad.

Ku High Band LO

This field is used to set the Ku high-band local oscillator frequency (in GHz) in a dual LNB Ku-Band system (when the *Band* is set to Dual Ku/Downlink Freq or High Ku/L-Band Freq). The default setting is **10.60 GHz**.

To change this setting, press **CHAN.** σ or **CHAN.** τ until the frequency setting you want is displayed or directly enter the number using the keypad.

Ku Band Switch

This field is currently not used. The feature will be available in the future.

Troubleshooting the D9223 Receiver

Types of Signal Interference

Types of terrestrial interference known to cause problems with digital compression signals are out-of-band interference such as aircraft radar altimeters, commercial microwave ovens, and/or in-band interference from hand-held electrical or combustion engine equipment operated near the receive antenna.

Adjacent-band radar altimeter interference

Aircraft radar altimeters do not operate in the 3.7 to 4.2 GHz band, but are close enough in frequency that they can produce interference strong enough to saturate the LNB and/or receiver.

Radar altimeter interference can be eliminated by installing an off-the-shelf microwave filter designed specifically for out-of-band signals. These microwave filters are installed between the feed assembly of the antenna and the LNB.

Industrial/microwave equipment interference

This form of microwave interference typically originates from industrial microwave ovens operated in factories and commercial sites, and interferes primarily with transponder #24. Microwave signal levels produced by these sources can be high enough to saturate the LNB and/or receiver. Generally, replacement of the offending Magnetron RF output tube will solve this problem.

Ignition noise interference

Ignition noise interference is typically broadband in nature and can interfere with the received signal. Ignition noise can be generated by faulty combustion engine ignition systems, hand-held electric dryers/blowers, or other electromagnetic equipment operated near the receive antenna. In most cases, the noise energy within the received channel can be tolerated, provided that receive/line amplifiers do not become saturated.

A signal input level of approximately -50 dBm is recommended for normal receiver operation. This allows sufficient receiver signal increases so that any

interference that takes place within the 3.7 to 4.2 GHz band (as well as adjacent bands) does not cause the receiver to become saturated. If other parts of the receive system become saturated, steps should be taken to eliminate the unwanted interference.

Ignition noise can be reduced or eliminated by restricting the use of combustion engines, hand-held electric dryers/blowers, or other electromagnetic equipment near the receive antenna.

Minimizing Signal Interference

Specific actions you can take to minimize the effects of local terrestrial interference are discussed in the following subsections.

Maintain an adequate signal level

The input signal level as provided to the receiver from the satellite LNB should be maintained between the values of 20 to 50 as displayed on-screen at the Installer menu.

Avoid signal saturation

If signal saturation is a problem, the LNB may require a attenuator installed before the receiver. Signal attenuation between approximately 6 to 20 dB can effectively reduce or eliminate the effects of signal saturation.

Signal levels should range from 20 to 40 for the lower power type carriers (<10Msymbols/s), and from 30 to 50 for larger, high power carriers; especially those which occupy a full transponder. Low signal levels accompanied by a high Bit Error Rate usually indicate excessive signal loss between the receiver and the antenna. High signal levels accompanied by a high Bit Error Rate usually indicate signal overloading at the receiver and/or line amplifier RF input.

Local Oscillator stability

To minimize the time required for synchronizing to a target carrier frequency, operate with a LNB having the LO frequency stability given in Table 4.23.

TABLE 4.23, LNB LOCAL OSCILLATOR STABILITY VS. CARRIER SYMBOL RATE

Symbol Rate	LNB LO Stability
> 3 MS.s and ≤ 6 MS/s	± 1.0 MHz
> 6 MS/s	± 1.5 MHz

Using line amplifiers, isolators, and filters

If you are using line amplifiers as part of your equipment installation, avoid saturating the line amplifier or overloading the receiver by locating the line amplifier at the appropriate distance from the LNB. Line amplifiers typically offer a gain of 20 dB, and should only be installed if the signal input cable length is approximately 50 to 100 meters.

The line amplifier used must be able to amplify the composite power of all the satellite transponders without distortion. An output 1 dB compression point of 0 to 10 dBm is usually sufficient in most cases. If installed, line amplifiers with noise figures under 7 dB provide the best signal-to noise ratio.

Antenna cross-polarization isolation should always be checked at the downlink. A misaligned LNB can introduce interference from other satellite signals.

If you are experiencing interference causing LNB overload from a radar signal existing outside the normal 3.7 to 4.2 GHz C-Band, a C-Band "block filter" can be installed before the LNB input. If installed, this type of filter can effectively reduce out-of-band interference and the effects of downlink path compression, and should not exceed 0.3 dB signal loss.

Be sure to terminate all splitter outputs, power dividers, and unused connectors, where necessary. Signal cables used should be low loss RG-11, with L-Band or equivalent rating.

Terrestrial in-band and out-of-band interference

The received signal level can be weakened and degraded because of local Terrestrial Interference (TI) originating from Earth-based, C-Band signal sources. Higher frequency Ku-Band signals are not affected by this type of interference. Both in-band and out-of-band local TI can adversely affect receiver operation.

Local, in-band interference that affects certain channels only is often caused by the antenna being located in or adjacent to the path of a microwave telecommunication signal tower. This source of interference can usually be identified with spectrum analyzer equipment. C-Band radar scatter originating from airport control towers can intermittently overload the LNB, and can be difficult to detect. The most common form of in-band interference is caused by noise spikes from electrical power or ignition systems, which are amplified by active components on the LNB and receiver. For this and other reasons, over-amplification of the LNB output signal can adversely affect the received digital signal. If local, in-band interference is present, installing a 10 dB C-Band attenuator pad at the input of the LNB will prevent signal saturation and compression.

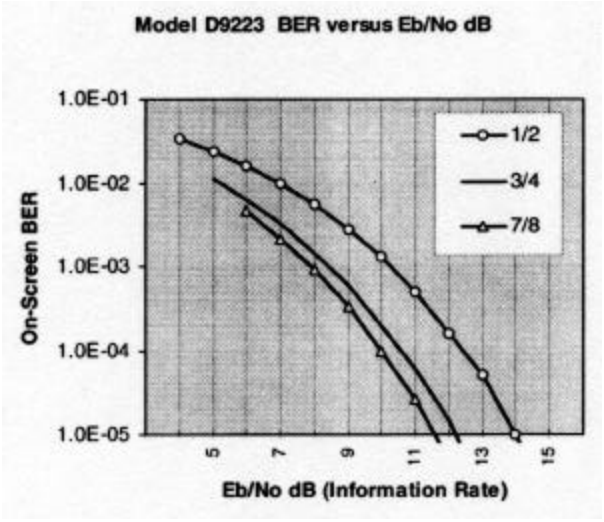
4	Some types of two-way radios or walkie-talkies can destructively interfere with a receiver because they use identical bands within the receiver IF frequency. Use of walkie-talkies should be restricted in the vicinity of the receiver.

Out-of-band interference can originate from a variety of sources. Aircraft radar altimeters are a common problem near airports. Commercial microwave ovens operating adjacent to TVRO station antennas have been known to interfere with digital compression signals. Installation of a C-Band bandpass filter before the LNB is recommended where there are known out-of-band interfering sources.

High Bit Error Rates

The Bit Error Rate (BER) associated with the received digital signal is extremely important, as it indicates how much of the received signal information contains errors caused by electrical noise/interference that must be corrected. The BER is displayed in scientific notation. For example, a received signal BER of 1E-5 (or 1.0 x 10-5) is less than a signal BER of 2E-3 (or 2.0 x 10-3). Figure 4.11 shows typical signal quality (BER) values obtained for various FEC rates as displayed on-screen at the Installer menu.

Figure 4.11, BER vs. Information Rate (typical)



The Eb/No (Information Rate) is normalized as the energy-per-bit for a 1 Hz noise bandwidth, and applies to any data rate. The Information Rate is the useful data rate following Forward Error Correction (FEC), as defined by the DVB standard. The threshold for Eb/No depends on the Viterbi FEC rate associated with the uplink signal. Table 4.24 lists the threshold Eb/No for each of the available FEC rates.

TABLE 4.24, FEC RATE AND CORRESPONDING THRESHOLD EB/NO

FEC	Threshold Eb/No (dB) (based on information rate)
1/2	4.5
2/3	5.0
3/4	5.5
5/6	6.0
7/8	6.4

For example, if the receiver is operating at 3/4 FEC, look at the middle curve in Figure 4.11. If the displayed BER is near 1E-2, this corresponds to a Eb/No of 5.5 dB (threshold). Below this threshold the video display is likely to break up, or signal synchronization can be lost. If the displayed BER is 1E-4, the receiver is operating at a Eb/No of 10.5 dB, which is approximately 5 dB over the

threshold. If the received downlink signal is Ku (that is, clear sky conditions), the displayed BER may be approximately 1E-4. With heavy precipitation, the BER is likely to increase to 1E-2, corresponding to a loss of 5 dB. The 1/2 FEC rate threshold corresponds to a BER of 3E-2, and the 7/8 FEC threshold to a BER of 3E-3.

The BER threshold for the Model D9223 receiver ranges from 5E-3 to 2E-2, depending on the FEC rate setting used. For example, the BER threshold for a FEC rate of 1/2 is 2E-2, 1E-2 for 3/4, and 5E-3 for 7/8. For safe operation, the BER associated with the received signal should be at least $1/10^{th}$ of the threshold (that is, for a FEC rate of 3/4, a BER of from 1E-3 to 1E-5 is considered ideal).

The received signal level can be weakened and degraded from precipitation (rain, ice, and snow) and from snow accumulation on the satellite antenna. Using the BER display is the best method for accurate antenna peaking. Common problems associated with a high BER are:

- Unterminated splitter port;
- Poor cabling or impedance mismatch;
- Marginal RF downlink signal level;
- Cross polarization; and
- Improperly pointed satellite antenna.

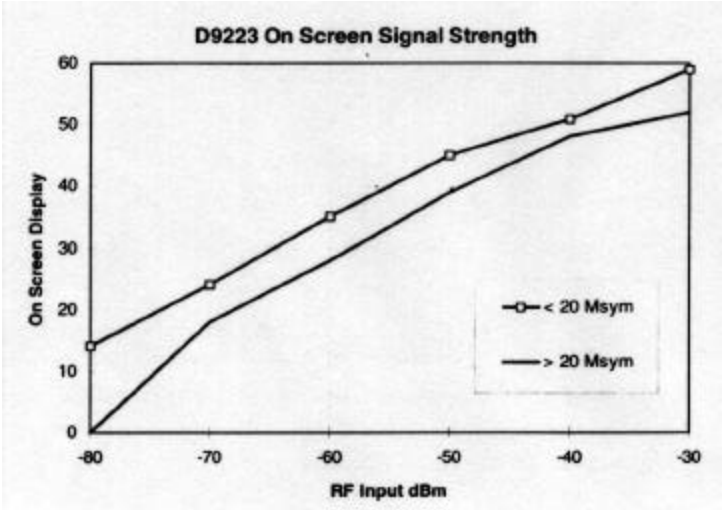
If no improvement in the BER is obtained after investigating these possibilities, faulty antenna or LNB equipment may be responsible for the problem. BER problems caused by low signal levels can be effectively improved by one or more of the following actions:

- Using higher-quality cable and connectors;
- Reducing the number of signal splitters and/or line amplifiers;
- Replacing the low gain LNB, if found to be faulty; and
- Installation of a line amplifier after a long cable run.

High BER caused by a high signal level

Figure 4.12 shows typical Signal Level values obtained for Symbol Rates above and below 20 <Symbols/s, as displayed on-screen at the Installer menu.

Figure 4.12, Signal Level vs. RF Signal Input



4	Displayed Signal Level values appear slightly higher for Symbol Rates below 20 MS/s than for Symbol Rates above 20 MS/s.

To reduce the possibility of tuner overload and the signal quality degradation that would result, the maximum RF signal input to the receiver is limited to -30 dBm for a full transponder RF carrier. A RF carrier of 3MS/s is a narrower bandwidth, and will carry approximately 10 dB less power than a full transponder RF carrier of 30MS/s.

For a Symbol Rate of 3.0 MS/s, the maximum RF input to the tuner should be -40 dBm, assuming that other full transponder (-30 dBm) signals may also be present at the tuner input. If sufficient cable/distribution loss exists between the LNB and the receiver, then the RF signal level will be significantly reduced, and the overall signal quality will be further degraded by the receiver tuner noise figure.

∫	If the displayed Symbol Rate is 30 MS/s, a Signal Level of 50 corresponds to approximately -30 dBm maximum RF input for this carrier. Similarly, a Signal Level of 25 corresponds to approximately -65 dBm RF input. Normally, the receiver would be operated somewhere between these two extremes.

A 10 dB attenuator pad installed before the receiver RF input (external LNB power switch set to OFF) can determine if the high BER is being caused by an unusually high signal level. Also, powering the LNB from a separate receiver/decoder using a splitter connection can assist in determining if the BER problem is being caused by the input signal level. If, after taking these steps, there is no marked improvement in BER, the problem is likely in the satellite antenna or the LNB. A LNB operating with an unstable or noisy local oscillator can adversely affect receiver performance.

Diagnostics Guide

Many reception problems are due to incorrect or deteriorated electrical conditions and improper antenna orientation. These items should be checked first, and if a problem still exists, the guide in Table 4.25 may provide a solution to some common problems. If the problem still persists after consulting the diagnostics guide below, contact your system administrator.

4	Temporary, solar-related electromagnetic disturbances occur every year during the spring and autumn months. These disturbances usually persist for several minutes a day for approximately one week during these periods. For more information on solar outages, see Chapter 9, Standard Maintenance Procedures.

TABLE 4.25, DIAGNOSTICS GUIDE

SYMPTOM	CAUSE	SOLUTION
Front panel displays " • "	Receiver is OFF (on stand-by)	- Press STANDBY button on the front panel to activate the receiver
Front panel is off	Receiver is unplugged or AC power is interrupted	- Check the AC power cord and electrical outlet.
No signal Signal Level <20	No DC power supplied to LNB	- Check external LNB DC power source (if using an external power supply), or verify that LNB power switch (receiver rear panel) is set to ON (if using internal power supply in receiver)
	Faulty LNB or cable Connection	- Check cable. Measure the LNB power output voltage. It should be +13V or +19V DC ±10% - Check that LNB cable does not exceed maximum length, and/or that signal splitters do not have missing terminations, which can cause excessive signal loss
No signal Signal Level >20	Incorrect receiver settings	- Check RF frequency and other front panel/menu setup options
	Incorrect LNB polarity	- Verify/connect proper LNB polarity - Contact your dealer/reseller or local service provider for assistance

SYMPTOM	CAUSE	SOLUTION
	Incorrect antenna orientation	- Aim antenna for peak reception according to manufacturer's instructions (use a standard analog receiver tuned to a NTSC or PAL signal to confirm correct antenna position)
	Line-of-sight obstruction	- Relocate antenna or remove obstruction
Signal with high BER Signal level >20	Receiver has synchronized to a digital signal, but the signal is weak and the error rate is very high.	- Check antenna orientation. Use an analog receiver tuned to a PAL or NTSC signal to peak the antenna signal by minimizing white and black dots - Check that cable run from LNB to receiver is not too long (some cable types have high losses) - Check that cable does not have multiple (more than three) splits
Signal with high BER Signal level > 50	Signal too strong because line amplifiers installed after LNB	- Remove extra amplifier(s) and and/or add signal attenuator pads
No video or audio Signal LED is flashing	Receiver is tuned to a digital signal, but is not authorized for the service currently on transmission	- Check with your distributor to see if you are authorized to receive the service
Receiver does not accept input on front panel keypad	Front panel buttons are disabled by Lock Level setting	- Lock level is set to Loc3 or Loc4. Check setting and if Lock Level 3, set to level required

4	If no authorized service(s) is received, the cause may be due to poor signal strength, a distorted signal, improper installation or equipment failure. Note that an antenna cannot be peaked by observing white and black dots in the video from a digital signal. If the signal strength is adequate, the video appears perfect. Likewise, if the signal strength is below threshold, no video is displayed at all.

STANDARD COMMUNICATIONS Model MT900 Satellite Receiver

Overview

The MT900 Intercontinental is an international, multi-standard, broadcast quality satellite receiver designed to operate in the phase lock loop (PLL)-synthesized, 950 to 1750 MHz frequency range. The MT900 has digitally-locked, continuous-tuning automatic frequency control (AFC) and microprocessor controls. Both C-band and Ku-band radio frequency (RF) inputs at 950 to 1750 MHz are converted to a commercial, industrial-standard 70 MHz intermediate frequency (IF).

The front panel design of the MT900 uses a 3-function meter that displays signal strength, fine tune, and carrier-to-noise ratio (C/N). The C/N meter and alarm features of the receiver continuously monitor input signals. The tune meter allows precise fine-tuning of the received signal. The signal meter is calibrated to read in dBm units.

Multiple video low-pass filters and de-emphasis networks enable the MT900 to operate in the transmission formats of NTSC, PAL, SECAM, and MAC. All known video scrambling formats are also possible. The power supply with three voltage settings decreases heat and power consumption. The receiver is designed for continuous operation.

The MT900 receiver design is a flexible, open architecture, with optional equipment that can be installed. These options include:

- CAD900A Option — This is a monaural audio option. It is a PLL, frequency-agile, mono-channel audio demodulator. It offers three adjustable IF filters at 220, 440, and 880 KHz, and multiformat audio-adjustable de-emphasis networks between 50 and 75 µsec and J-17;

- CAD930 Option — This audio option offers PLL, frequency-agile, dual-channel stereo demodulation. Five adjustable IF filters are available at 55, 110, 220, 440, and 880 KHz. Multiformat audio de-emphasis networks are available at 50 µsec, 75 µsec, J-17, and sliding. A flat audio spectrum, without de-emphasis, is also available; and

- CMF900 Option — This option is a front panel-adjustable module, with multiple 70 MHz IF bandpass filters of widths: 16, 18, 22, 25, 27, and 36 MHz.

Features

The following list summarizes the features available on the SCC MT900 Intercontinental satellite receiver.

- Rebroadcast quality, certified performance on NTSC, PAL, SECAM, and MAC signals.

- Attractive and easy to install in a standard 19-inch rack.
- Precision microprocessor-controlled, dual-conversion, PLL RF tuning.
- Low-profile chassis design, for reduced rack space consumption.
- Digital AFC tracking circuit with continuous fin-tuning ability.
- Multitap power supply, with three voltage settings.
- 70 MHz IF with spectrum inversion circuit for uplink turnarounds.
- Monaural audio option available.
- Multifunction analog front panel meter.
- Multi-standard broadcast-quality stereo audio demodulator option available.
- Built-in alarm contacts.
- High-quality terminal strips are easily wired for whichever configuration is chosen.
- TI (terrestrial interference) loop and front panel test points for video and 70 MHz IF.

See Table 4.26 for general specifications of the MT900 receiver:

TABLE 4.26, MT900 RECEIVER GENERAL SPECIFICATIONS

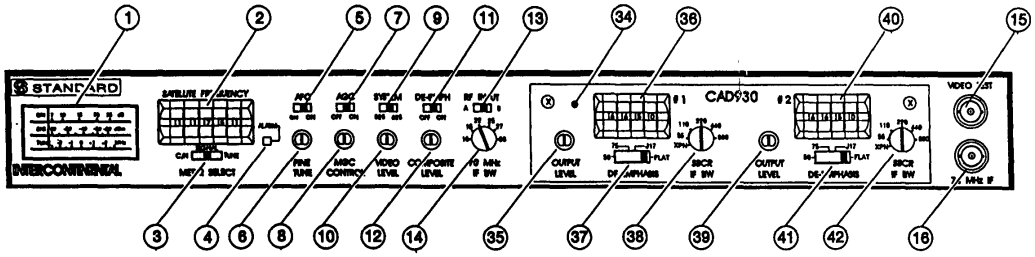
SPECIFICATION	VALUE
Input Voltage	115/230/240 VAC
Line Frequency	50 to 60 Hz
Operating Power (Maximum)	45 W
With Options	≤ 55 W
Operating Temperature Range	+14 to +122 °F (-10 to +50 °C)
Input Impedance	75 ohms
RF Frequency Range	950 to 1750 MHz
Input Level	-20 to –65 dBm
Noise Figure	≤ 13 dB
Stock IF Bandwidth	27 MHz
Fine-Tuning Range	2.0 MHz
First IF Center Frequency	612 MHz
Second IF Center Frequency	70 MHz
AFC Capture Range	± 2.0 MHz
Dimensions	1.75 x 19 x 18.9 in. (45 x 483 x 480 mm)

Operations

Front Panel Indicators

Figure 4.13 shows the locations of the MT900 receiver front panel controls. Numbers in parentheses in the text (for example, "(2)") refer to callout numbers on the figure. Brief descriptions of these controls are given following the figure.

Figure 4.13, MT900 Front Panel



Meter (1)

At the far left of the front panel is the 3-function analog meter (1). The function of the meter is selected by the METER SELECT switch (3). There are three possible functions:

SIGNAL position indicates the RF signal strength from –20 to –60 dBm.

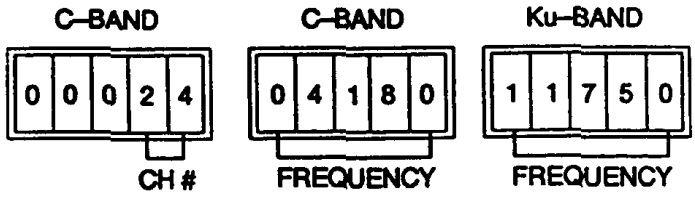
TUNE position indicates the relative difference between the center frequency that was preprogrammed into the receiver and the signal to which the receiver is actually tuned (or tracking with the AFC).

C/N (Carrier-to-Noise ratio) position indicates the received signal C/N ratio at 70 MHz from 7.0 to approximately 25 dB.

Satellite Frequency (2)

Next to the analog meter is the SATELLITE FREQUENCY thumbdial (2). The desired satellite frequency is manually set with this thumbdial. The thumbdial can be used to select either RF frequency from 950 to 1750 MHz or channel number, depending upon the settings of two switches located inside the receiver. These must select the desired format, and are set when the receiver is installed. The examples in Figure 4.14 show the various dial settings, the first being a channel number for C-band, and the others for C-band and Ku-band frequencies.

Figure 4.14, Satellite Frequency Thumbdial Settings



Meter Select (3)

This switch is a 3-position sliding switch (3), which can select among C/N, TUNE, or SIGNAL functions for display on the front panel meter (1).

Alarm (4)

This is a light-emitting-diode (LED) that lights if:

- C/N is less than 7dB;
- A bandwidth other than 27 dB is selected (and the CMF900 audio option is not installed);
- An illegal entry is made on the satellite frequency thumbdial (2);
- LNB (low-noise block downconverter) power overcurrent; or
- Low-signal input occurs.

AFC (Automatic Frequency Control) (5)

This switch is a 2-position Off/On slide switch. In the ON position, AFC circuitry locks on to incoming RF signals within ± 2 MHz of the selected center RF frequency. In the OFF position, AFC is disabled, and the receiver remains tuned to the programmed RF frequency. In this state, however, the FINE TUNE control (6) can be used to offset the receiver from the programmed RF frequency manually by ± 2 MHz. Relative variation from the programmed center frequency is indicated by the TUNE function of the Meter (1). This display is available whether the AFC switch is ON or OFF.

Fine Tune (6)

This control is a potentiometer for fine tuning the frequency offset from the programmed RF center frequency. Its range is approximately ± 2 MHz. The effects of adjusting this control can be monitored on the Meter (1) when the METER SELECT switch (3) is in the TUNE position. The adjustment is observable in both AFC (5) ON and OFF positions when fine-tune adjusting.

AGC (Automatic Gain Control) (7)

This 2-position On/Off slide switch selects automatic or manual IF gain. In the ON position, circuitry automatically controls the output level at a constant. In the OFF position, the MGC (manual gain control) (8) is activated.

MGC (Manual Gain Control) (8)

This potentiometer control is active only when the AGC switch (7) is in the OFF position. A clockwise (CW) rotation increases IF gain, while a counterclockwise (CCW) rotation decreases IF gain.

System (9)

This 2-position slide switch selects either 525-line or 625-line de-emphasis and video low-pass filter (LPF). The LPF for 525-line video is 4.5 MHz. The LPF for 625-line video is 5.0 MHz.

Video Level (10)

This potentiometer provides adjustment of the video level between 0.5 and 1.0 V peak to peak (p-p) when VIDEO OUTPUT connectors (24) and (25) are terminated with a 75-ohm load. The VIDEO OUTPUT connector (25) does not require a load.

De-Emphasis (11)

This 2-position ON/OFF switch controls insertion of video de-emphasis into the signal present at the COMPOSITE OUTPUT connector (23). It is used for MAC compatibility with the switch in the OFF position. This switch does not affect the signal at VIDEO OUTPUT connectors (24) and (25).

Composite Level (12)

This potentiometer provides adjustment of the composite output level when the COMPOSITE OUTPUT connector (23) is terminated with a 75ohm load.

RF Input (13)

This 2-position slide switch selects between A and B RF ANTENNA INPUTs. This switch affects the signal at the rear panel ANTENNA RF INPUT connectors (17) and (18) for whichever antenna input is chosen (A or B). The center conductor 24 VDC is active only on the A or B position selected. The current-limited 24 VDC is for external use by LNBs or amplifiers on the incoming signal cable.

70 MHz IF Bandwidth (14)

This 6-position rotary switch selects IF bandwidth for the CMF900 Multiple Bandpass Filter option. With this option installed, refer to the section on Operation of the receiver. If this option is not installed, the setting is 27 MHz.

Video Test (15)

This BNC connector is for sampling the baseband output at the VDIEO OUTPUT connectors (24) and (25). This connector does not require termination when not in use.

70 MHz IF (16)

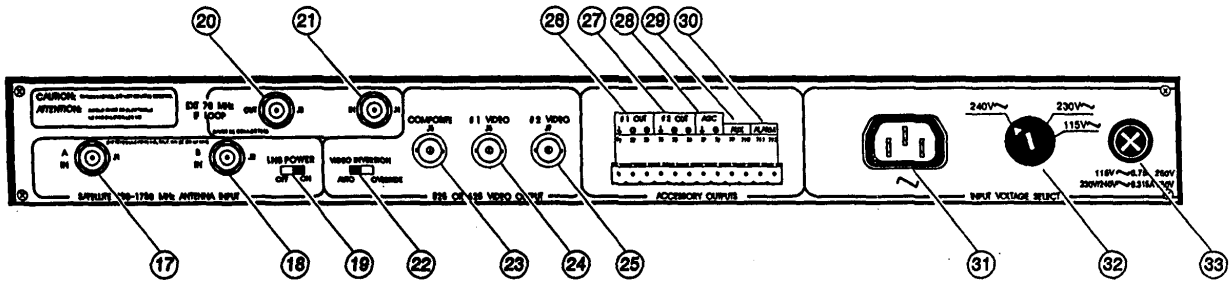
This BNC connector provides a 70 MHz IF signal to the front panel.

Rear Panel Controls and Connections

Figure 4.15 shows the locations of the MT900 receiver rear panel controls and connectors. Numbers in parentheses in the text (for example, “(17)”) refer to

callout numbers on the figure. Brief descriptions of these controls and connectors are given after the figure:

Figure 4.15, Rear Panel Controls and Connections



A IN (17)

On the far left of the rear panel, this F-type connector is one of the two source antenna input connectors for 950 to 1750 MHz signals. It is selected from RF INPUT switch (13).

B IN (18)

This f-type connector is one of the two source antenna input connectors for 950 to 1750 MHz signals. It is selected from RF INPUT switch (13).

LNB Power (19)

This 2-position OFF/ON switch the 24 VDC onto the center conductor of the 950 to 1750 MHz A and B IN connectors (17) or (18). In the OFF position, the 24 VDC is removed.

EXT 70 MHz IF LOOP OUT (20)

This f-type connector provides a 70 MHz output to the rear panel for external filters or special applications.

EXT 70 MHz IF LOOP IN (21)

This f-type connector provides a 70 MHz input to the rear panel for external filters or special applications.

VIDEO INVERSION (22)

This 2-position slide switch inverts the input video signal. In the AUTO position, it maintains the same 70 MHz IF video waveform as the satellite signal. In the OVERRIDE position, it reverses the polarity of the 70 MHz IF video waveform.

This switch changes the signal at the front panel VIDEO TEST connector (15) and rear panel COMPOSITE OUTPUT connector (23) and VIDEO OUTPUT connectors (24 and (25) by selecting either normal or inverted video. This allows compensation for nonstandard downconverter local oscillator frequencies, while

maintaining normal video polarity when transferring an uplink signal on another band.

COMPOSITE OUTPUT (23)

This BNC connector provides 30 Hz to 10 MHz unclamped composite video for use with a video descrambler or an audio subcarrier demodulator. The signal is adjustable from 0.5 to 1.5 V p-p by the COMPOSITE LEVEL control (12) on the front panel. If the video signal is inverted, it may be set to normal by the rear panel VIDEO INVERSION switch (22). De-emphasis normally present in the composite signal can be removed by the DE-EMPH OFF/ON switch (11).

#1 VIDEO OUTPUT (24)

This BNC connector provides low-pass-filtered (9), clamped baseband video for use by a monitor or RF modulator. The output level is adjustable from 0.5 to 1.5 V p-p by the front panel VIDEO LEVEL potentiometer (10). The energy-dispersal signal is normally not present with the video signal at this output. If the video signal is inverted, it may be set to normal by the rear panel VIDEO INVERSION switch (22). The clamp is preset to **sync tip** mode. It can be set to either **back porch** or **sync tip** by internal switch SV01 (49). See the TVRO Installation Manual for more information on setting this internal switch.

#2 VIDEO OUTPUT (25)

This BNC connector provides low-pass-filtered (9), clamped baseband video for use by a monitor or RF modulator. The output level is adjustable from 0.5 to 1.5 V p-p by the front panel VIDEO LEVEL potentiometer (10). The energy-dispersal signal is normally not present with the video signal at this output. If the video signal is inverted, it may be set to normal by the rear panel VIDEO INVERSION switch (22). The clamp is preset to sync tip mode. It can be set to either back porch or sync tip by internal switch SV01 (49). See the *TVRO Installation Manual* for more information on setting this internal switch.

#1 ACCESSORY OUT (26)

These screw terminals provide balanced, 600 ohm audio + and – output for the #1Audio subcarrier output signal. This signal is used with either the CAD900A or CAD930 Audio Demodulator options.

#2 ACCESSORY OUT (27)

These screw terminals provide balanced, 600 ohm audio + and – output for the #1Audio subcarrier output signal. This signal is used with either the CAD900A or CAD930 Audio Demodulator options.

AGC (28)

These screw terminals provide an AGC output point for test purposes or for remote monitoring of signal level. The AGC is a positive DC voltage, which is directly proportional to the RF input signal amplitude.

AUX (29)

These screw terminals have been installed for future use.

ALARM (30)

These screw terminals provide a dry contact when the ALARM LED (4) turns on. The ALARM LED lights if:

- The C/N is LESS than 7 dB;
- A bandwidth other than 27 dB is selected, and the CMF900 option is not installed (see TVRO Installation Manual);
- An improper entry is made on the satellite frequency thumbdial (2);
- An LNB power overcurrent occurs; and
- The RF input signal is greater than –65 dBm.

When there is an AC power loss, the LED will not light, but a dry contact is triggered. Switch **SC01** (48) sets to a normally open (N/O) or normally closed (N/C) condition for the alarm.

POWER (31)

This is an **IEC-320** power receptacle.

INPUT VOLTAGE SELECTOR (32)

This 3-position switch selects the input AC line voltage. Voltage settings available are **230 V, 240 V**, or **115 V**.

FUSE (33)

This receptacle accepts the proper fuse for the AC line voltage in use at the site. For 115 VAC, the proper fuse is rated at 0.8 Amperes, 250 VAC. For 230/240 VAC, the proper fuse is rated at 0.315 Amperes, 250 VAC.

4	When switching line voltages, change the fuse to one of the proper value.

CAD930 Demodulator (Option) Controls and Connections

Figure 4.13 shows the locations of the CAD930 Demodulator option controls on the MT900 Receiver front panel. Numbers in parentheses in the text (for example, "(35)") refer to callout numbers on the figure. Brief descriptions of these controls and connectors are given below:

OUTPUT LEVEL (35)

This potentiometer provides for the adjustment of the #1 audio output level.

AUDIO SUBCARRIER FREQUENCY #1 (36)

This thumbdial is used to set manually the desired audio #1 subcarrier frequency.

DE-EMPHASIS (37)

This 4-position slide switch selects the de-emphasis used for the #1 audio output. Settings available are: **50 msec, 75 msec, J17**, or **Flat**.

IF BW (38)

This 5-position rotary switch selects Audio #1 subcarrier bandwidths. Bandwidths available are: **55, 110, 220, 440**, or **880 kHz**. The IF bandwidths at 55 and 110 kHz are preset to introduce a sliding de-emphasis network. This network can be disabled by turning the switch SE01 located on PE01 to the OFF position. Refer to Figure 3.29 in the *TVRO Installation Manual* for more information on setting switch SE01.

To receive compressed audio, set the IF to 55 or 110 kHz and the de-emphasis to 75 µsec.

4	XPN is not a position. It is active only when the 55 and 110 kHz bandwidths are selected for narrow-band demodulations that require a sliding de-emphasis. When the selector switch is positioned after 880 kHz or before 55 kHz, it defaults to 880 kHz.

OUTPUT LEVEL (39)

This potentiometer provides adjustment of the #2 audio output level.

AUDIO SUBCARRIER FREQUENCY #2 (40)

This thumbdial is used to set manually the desired audio #2 subcarrier frequency.

DE-EMPHASIS (41)

This 4-position slide switch selects the #2 audio de-emphasis. Settings available are: **50 msec, 75 msec, J17**, or **Flat**.

IF BW (*42)*

This 5-position rotary switch selects Audio #2 subcarrier bandwidths. Bandwidths available are: **55, 110, 220, 440**, or **880 kHz**. The IF bandwidths at 55 and 110 kHz are preset to introduce a sliding de-emphasis network. This network can be disabled by turning the switch SE02 located on PE01 to the OFF position. Refer to figure 4.26 in the *TVRO Installation Manual* for more information on setting switch SE02.

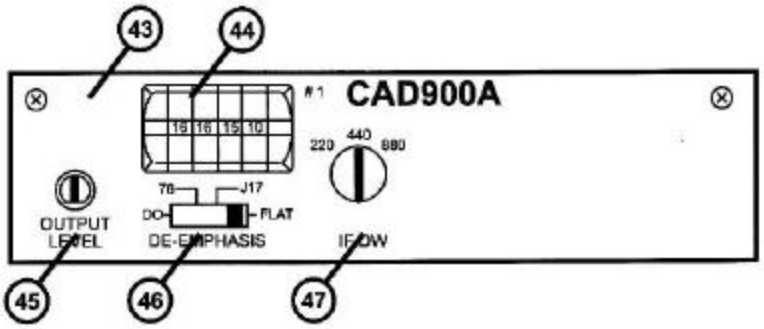
To receive compressed audio, set the IF to 55 or 110 kHz and the de-emphasis to 75 µsec.

4	See the note above about the XPN position.

CAD900A Demodulator (Option) Controls and Connections

Figure 4.16 shows the locations of the controls on the CAD900A Demodulator option, which substitutes for the CAD930 Demodulator option on the MT900 Receiver front panel. Numbers in parentheses in the text (for example, "(44)") refer to callout numbers on the figure.

Figure 4.16, CAD900A Demodulator Option Controls and Connections



Brief descriptions of these controls and connectors are given below:

AUDIO SUBCARRIER FREQUENCY (44)

This thumbdial is used to set manually the desired #2 audio subcarrier frequency.

OUTPUT LEVEL (45)

This potentiometer adjusts the CAD900A monaural output level.

DE-EMPHASIS (46)

This 4-position slide switch selects the desired CAD900A audio de-emphasis. Settings available are: **50 msec, 75 msec, J17**, or **Flat**.

IF BW (47)

This rotary switch selects the desired CAD900A subcarrier IF bandwidth. Settings available are: **220, 440**, or **880 kHz**.

Internal Switches

Figure 4.17 shows the location of the four MT900 internal switches. These switches are preset to certain default values, but may be changed to suit the requirements of your receiving site. See Table 4.26 to identify the switches and their preset values:

Figure 4.17, MT900 internal switches

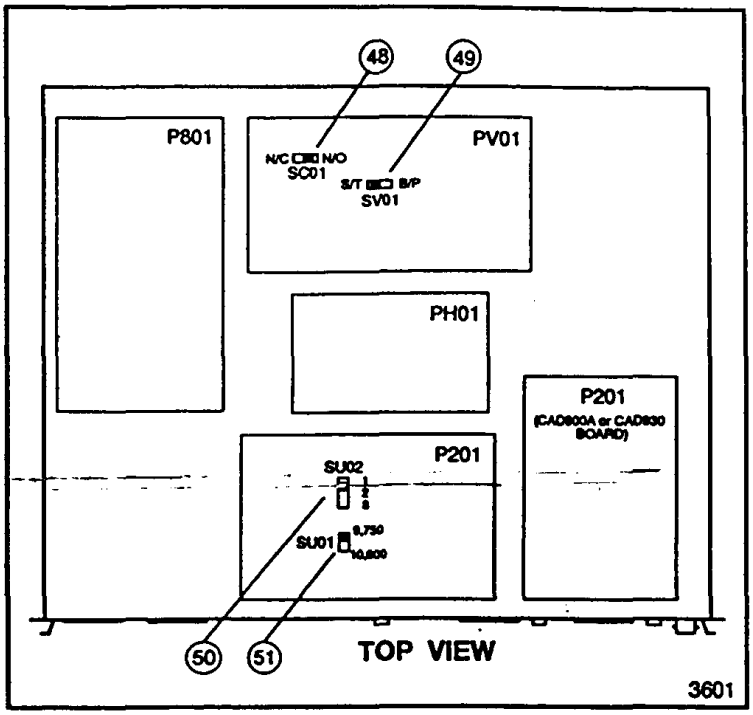


TABLE 4.26, INTERNAL SWITCH DEFAULT SETTINGS

SWITCH	DEFAULT SETTING
SC01	N/O
SV01	S/T
SU01	10000 MHz
SU02	Position 1

Numbers in parentheses in the text (for example, "(48)") refer to callout numbers on the figure. Brief descriptions of these switches are given below:

SUMMARY ALARM SWITCH SC01 (48)

This 2-position slide switch is use for setting the alarm to **N/O** or **N/C**. The switch is preset to **N/O**.

*CLAMP SWITCH SV*01 (49)

This 3-position slide switch selects either **S/T** (sync tip) or **B/P** (back porch) clamping. The switch is preset to **S/T**.

4	For sound-in-synch operation, set Svo1 to B/P. For unclamped video, set SV01 between S/T and B/P.

LO SELECT SWITCH SU02 (50)

This 3-position slide switch selects for the desired frequency range. Refer to Table 4.19, Internal Switch Default Settings for the proper position. The **SU02** switch is preset for Position 1.

LO SELECT SWITCH SU01 (51)

This 2-position switch selects either of the two frequencies **9750** or **10000 MHz**. Refer to Table 4.19, Internal Switch Default Settings for the proper setting. This switch is preset for 10000 MHz. If the frequency thumbdial is set to any frequency outside those listed in the table, the ALARM LED lights.

STANDARD COMMUNICATIONS Model MT620 Satellite Receiver

Overview

The MT620 Continental is an international, multi-standard commercial-quality 950 - 2050 MHz satellite receiver. The MT620 features a fully synthesized PLL tuning circuit. The tuning logic provides continuous tuning AFC and microprocessor control with 100 kHz accuracy. Multiple video low-pass filters and de-emphasis networks provide commercial-quality performance for NTSC, PAL, SECAM, and MAC operation, along with all known video scrambling formats.

The multi-tap power supply with two voltage settings decreases heat and power consumption, and is designed for continuous operation 24 hours a day. You can select a microprocessor-controlled 24-channel frequency, or dial the desired frequency directly. The MT620 automatically tracks all known LNBs without conversion charts

The flexible receiver design is an open architecture with field-installable options. The MT620 can be ordered with the CAD620 option. This option provides a second audio channel (#2 audio subcarrier) with PLL frequency-agile audio demodulator. When set at 110 kHz bandwidth, this option supports Panda 1® 15 kHz companded audio only.

4	In order for the #1 audio subcarrier to work in Panda mode, set SBCR IF BW on the MT620 front panel to the Narrow position, and set Audio De-Emph on the MT620 front panel to 75 µs.

Features

The following list summarizes the features available on the Standard Communication MT620 satellite receiver:

- Commercial-quality performance on NTSC, PAL, and SECAM signals;
- AFC tracking circuit with continuous fin-tuning ability to correct for LNB drift;
- Two IF bandpass filter (27 MHz = wide bandwidth; 18 MHz = narrow bandwidth);
- AGC tuning voltage for antenna peaking;
- Five-segment bar graph RF signal meter;
- Microprocessor-controlled single-conversion PLL RF tuning; and
- Multi-standard frequency-agile audio demodulator.

TABLE 4.27, MT620 RECEIVER GENERAL SPECIFICATIONS

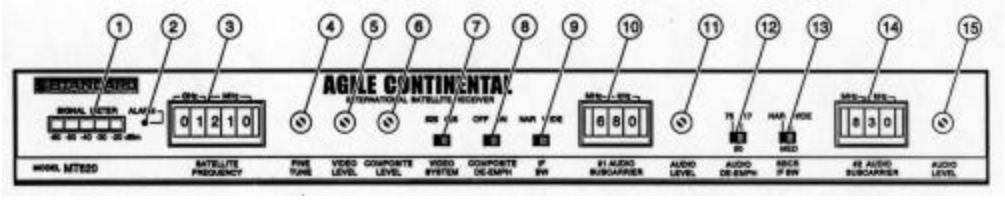
SPECIFICATION	VALUE
Input Voltage	110/220 VAC
Line Frequency	50 to 60 Hz
Operating Power (Maximum)	28 W
With Options	28 W
Operating Temperature Range	+14 to +122 °F (-10 to +50 °C)
Input Impedance	75 ohms
RF Frequency Range	950 to 2050 MHz
Input Level	-20 to –80 dBm
Noise Figure	≤ 13 dB
Narrow IF Bandwidth	18 MHz
Wide IF Bandwidth	27 MHz
Fine-Tuning Range	±2.0 MHz
AFC Capture Range	± 3.0 MHz
Dimensions	1.75 x 19 x 12 in. (4.5 x 48.3 x 30.5 cm)

Operations

Front Panel Indicators

Figure 4.18 shows the location of the MT620 receiver front panel controls. Number in parentheses in the text (for example, "(2)") refer to callout numbers on the figure. Brief descriptions of these controls are given in the subsections to follow.

Figure 4.18, MT620 Front Panel



Signal Meter (1)

At the far left of the front panel, a five-segment LED indicates the signal strength from -20 to -60 dBm.

Alarm (2)

The LED lights to indicate one of the following conditions:

- Illegal entry on the Satellite Frequency thumbdial (3);
- LNB power over-current; and

- Low signal input.

Satellite Frequency (3)

To the right of the alarm LED (2) is the Satellite Frequency thumbdial, which is used to set manually the desired RF tuning range to a channel number (1 - 24) of the desired satellite band frequency (950 - 2050 MHz). Table 4.28 is a tuning chart that can be used to set the internal switch SU02 to correspond to the LNB that your satellite antenna uses.

TABLE 4.28, TUNING CHART

Thumb Dial	SU02	LO MHz	RX Freq Mix	Band	IF/Video Polarity
00001 - 00024	-	5150	1450 - 950	C	C
00950 - 02050	-	0	950 - 2050	-	Ku
02500 - 02690	-	3650	1150 - 960	S	S
03100 - 04200	-	5150	2050 - 950	C	C
10700 - 11700	1	9750	950 - 1950	Ku	Ku
	2	10000	950 - 1700	Ku	Ku
	3	9750	950 - 1950	Ku	Ku
11701 - 12500	1	10600	1101 - 1900	Ku	Ku
	2	10750	951 - 1750	Ku	Ku
	3	10475	1226 - 2025	Ku	Ku
12501 - 12750	1	11475	1026 - 1275		
	2	11300	1201 - 1450		
	3	11000	1501 - 1750		

Fine Tune (4)

A recessed, slotted adjustment for fine-tuning the offset from the programmed RF center frequency. The range is approximately ± 2 MHz.

Video Level (5)

A recessed, slotted control for adjusting the video level between 0.5 and 1.0 V p-p when the Video Output connector (20) is terminated into a 750ohm load.

Composite Level (6)

This recessed, slotted control provides adjustment of the composite output level when the Composite Output connector (19) is terminated into a 75-ohm load.

Video System (7)

A two-position slide switch that selects either 525- or 625-line de-emphasis ahd video LPF. The LPF for 525-line video is 4.5 MHz, and the LPF for 625-line video is 5.0 MHz.

Composite De-Emph (8)

A two-position On/Off switch for controlling insertion of video de-emphasis into the signal present at the Composite Out connector (19).

IF BW (9)

This two-position slide switch selects a narrow (18 MHz) of wide (27 MHz) bandwidth filter for the video channels.

#1 Audio Subcarrier (10)

A thumb dial that selects the primary audio channel.

4	When the CAD620 option is installed, you can use the #2 Audio Subcarrier thumb dial (14) to select a second audio channel. However, note that the following controls only affect the #1 audio channel: Audio De-Emphasis (12) and SBCR IF BW (13).

Audio Level (11)

A recessed, slotted adjustment for controlling the volume for the audio channel selected by the #1Audio Subcarrier thumb dial (10). Turn the control to the left to decrease the volume. Turn the control to the right to increase the volume.

Audio De-Emph (12)

This three-position slide switch selects the proper audio de-emphasis: 50, 75, or J17.

SBCR IF BW (13)

A three-position slide switch that selects the audio bandwidth: narrow (110 kHz), medium (330 kHz), or wide (440 kHz). The narrow bandwidth is not available unless the CAD620 option is installed.

#2 Audio Subcarrier (14)

A thumb dial for selecting the second audio channel. This channel uses a narrow bandwidth for Panda 1® audio. This control is not available unless the CAD620 option is installed.

Audio Level (15)

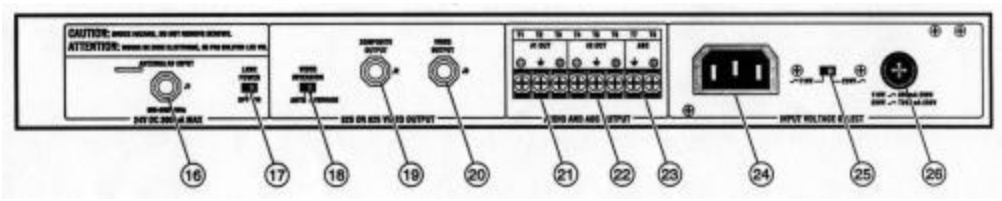
This recessed, slotted adjustment controls the volume for the audio channel selected by the #2 Audio Subcarrier thumb dial (14). Turn the control to the left

to decrease the volume. Turn the control to the right to increase the volume. This control is not available unless the CAD620 option is installed.

Rear Panel Controls and Connections

Figure 4.19 shows the locations of the MT620 receiver rear panel controls and connectors. Numbers in parentheses in the text (for example, "(16)") refer to callout numbers on the figure. Brief descriptions of these controls and connectors are given in the subsections to follow.

Figure 4.19, MT620 Rear Panel Controls and Connections



Antenna RF Input (16)

On the far left of the rear panel, the satellite antenna source input connects with 950 - 2050 MHz.

LNBC Power (17)

A two-position On/Off switch that allows control of the 24 VDC available to the center conductor of the Antenna RF Input connector (16). In the Off position, the 24 VDC is removed. The current-limited 24 VDC is for external use by LNBs or amplifiers on the incoming signal cable.

Video Inversion (18)

This two-position slide switch controls the signal at the rear panel Composite Output (19) and Video Output (20) connectors by causing either normal or inverted video. The Override position reverses the preprogrammed setting.

Composite Output (19)

A type F output connector providing 0 Hz to 10 MHz unclamped composite video for use with a video descrambler or an audio subcarrier demodulator. The signal is adjustable from 0.5 to 1.5 V p-p by the front panel Composite Level control (6). De-emphasis normally present in the composite signal can be removed by the Composite De-Emph switch (8).

Video Output (20)

This type F output connector provides a low pas filtered (7) clamped baseband video for use by a monitor or RF modulator. The output level is adjustable from 0.5 to 1.5 V p-p by the front panel Video Level control (6). The energy dispersal signal is normally not present with the video signal at this output. If the video signal is inverted, you can use the rear panel Video Inversion switch (18) to set the signal to normal.

Audio Output, #1 (21)

A screw terminal that provides the ± output of the #1 Audio Subcarrier 600-ohm balanced audio output.

Audio Output, #2 (22)

This screw terminal provides the ± output of the #2 Audio Subcarrier 600-ohm balanced audio output, if you have installed the optional CAD620 Audio Demodulator.

AGC (23)

A screw terminal providing an automatic gain control (AGC) output for test purposes or for remote monitoring of the signal level. The AGC is a positive DC voltage directly proportional to the RF input signal amplitude.

Power (24)

An IEC 320 power receptacle.

Input Voltage Select (25)

A recessed, slotted adjustment for setting the input voltage: 110 VAC or 220 VAC. Make sure that you use a suitable fuse (26) that is rated for the voltage your facility uses.

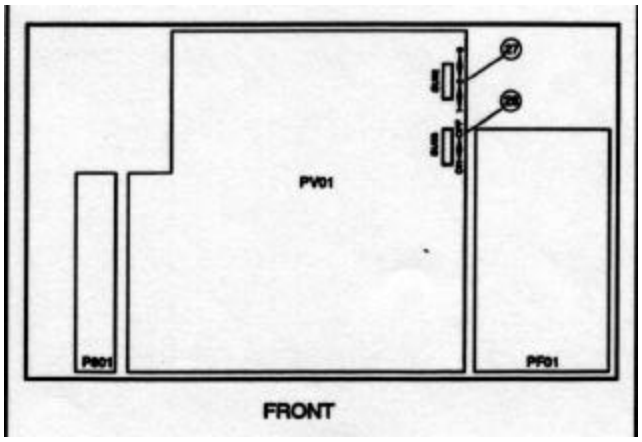
Fuse (26)

A line voltage fuse: 110V 0.8A; 220V 200mA.

Internal Switches

Figure 4.20 shows the location of the two MT620 internal switches. Numbers in parentheses in the text (for example, "(27)") refer to callout numbers on the figure. These switches may be changed to suit the requirements of your receiving site.

Figure 4.20, MT620 Internal Switches



Local Oscillator (LO) Select Switch (SU02) (27)

This three-position slide switch must be set to your satellite antenna's LNB. The switch is factory-set for position 2. Positions 1 and 3 are normally used for Ku-Band formats. Table 4.29 summarizes Ku-Band satellite frequency assignments. Also, refer to Table 4.28, which shows you how to set internal switch SU02 to tune the MT620 to your LNB.

TABLE 4.29, KU-BAND SATELLITE FREQUENCY ASSIGNMENTS

Region		Frequency (GHz)	Allocation
Region 1	Africa	10.95 - 11.70	Fixed Satellite Service
	Europe	11.70 - 12.50	Direct Broadcast Service
	Middle East	12.50 - 12.75	Business Band Service
Region 2	North America	11.70 - 12.20	Fixed Satellite Service
	Central America	12.20 - 12.70	Direct Broadcast Service
	South America		
Region 3	India	11.70 - 12.75	Fixed and/or Direct
	Asia		Broadcast Service
	Australia		
	The Pacific		

For example, if your satellite antenna uses a 5150 MHz LNB, you can directly select one of 24 channels. Using the Satellite Frequency thumb dial (3), set the channel to from 00001 to 00024.

Alternatively, you can dial the desired frequency directly. The value of the LNB (LO MHz) brings the signal down to the receiver's 950 - 2050 MHz range (RX Freq Mix).

Automatic Frequency Control (AFC) Select Switch (SU03) (28)

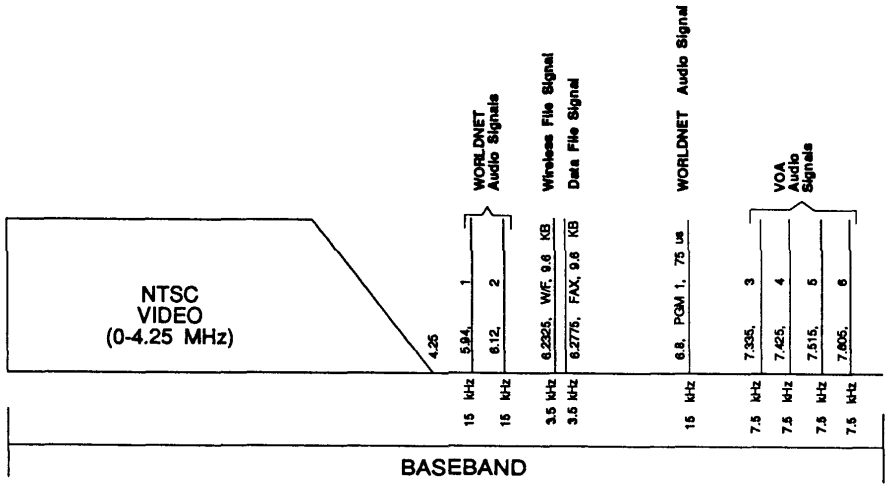
Switch SU03 is a two-position slide switch that turns automatic IF frequency control on or off. Set SU03 in the On position to automatically control the IF frequency.

WEGENER Receivers

Overview

The purpose of the Wegener receiver is to separate the Voice of America (VOA) audio signals and the wireless and data file signals from the subcarrier on the WORLDNET satellite television signal. Figure 4.21 illustrates the signal frequency assignment spectra of all WORLDNET broadcast signals.

Figure 4.21, WORLDNET PAL Signal Spectra



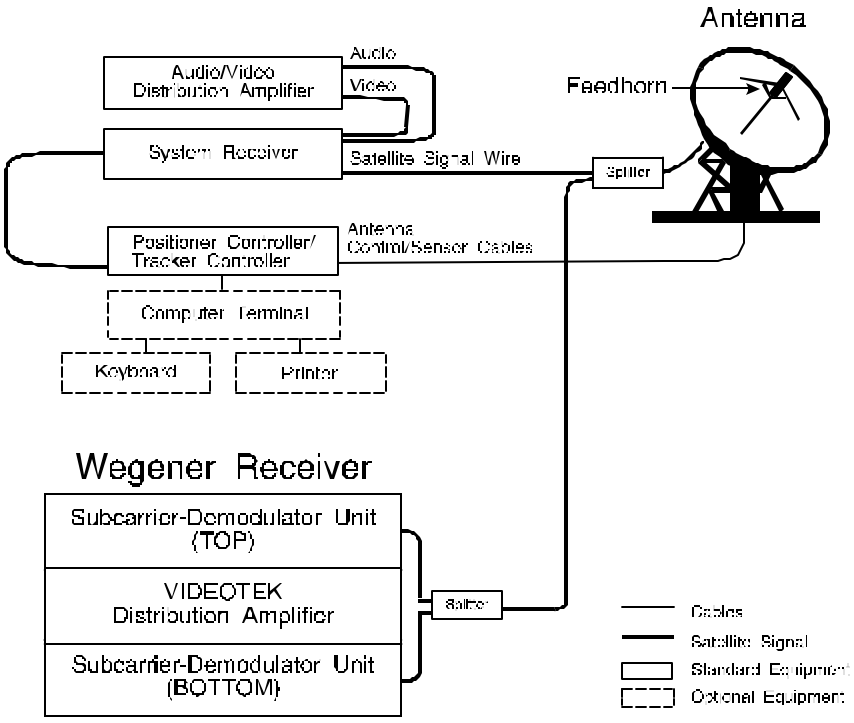
Features

The Wegener receiver consists of three subcomponents:

- A top audio subcarrier-demodulator unit;
- A VIDEOTEK distribution amplifier; and
- A bottom audio subcarrier-demodulator unit.

A signal splitter, spliced into the coaxial cable running from the antenna to the system receiver, splits the satellite signal, sending half of it to the system receiver and the other half to the Wegener receiver. Before reaching the Wegener receiver, the signal is split again, with these signals entering the top and bottom audio subcarrier-demodulator units. Figure 4.22 illustrates how the signal is split, as well as the relationship of the Wegener receiver's subsystems.

Figure 4.22, TVRO System Diagram Showing Wegener Units



The separation of the VOA, data, and wireless signals from the WORLDNET TV signal occurs within the audio subcarrier-demodulator units. The separated signals are then passed to the VIDEOTEK distribution amplifier for distribution to attached audio and computer equipment. Figures 4.23 and 4.24 illustrate these units.

Figure 4.23, Audio Subcarrier-Demodulator Unit, Rear Panel

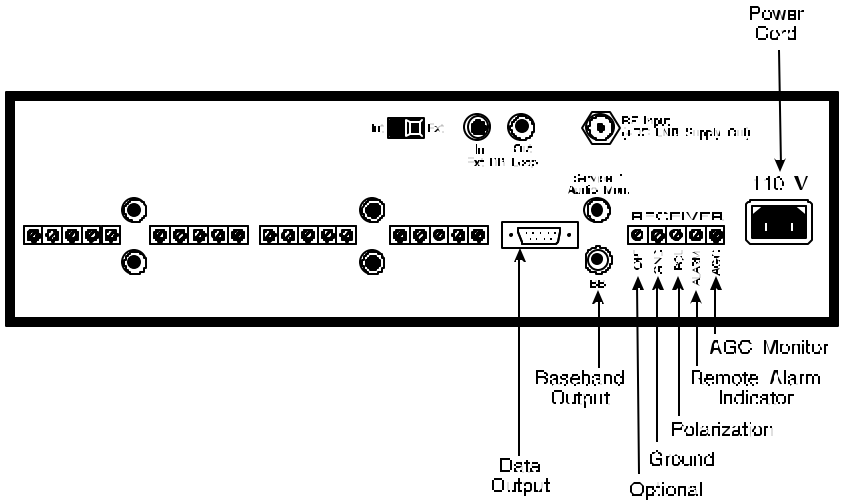
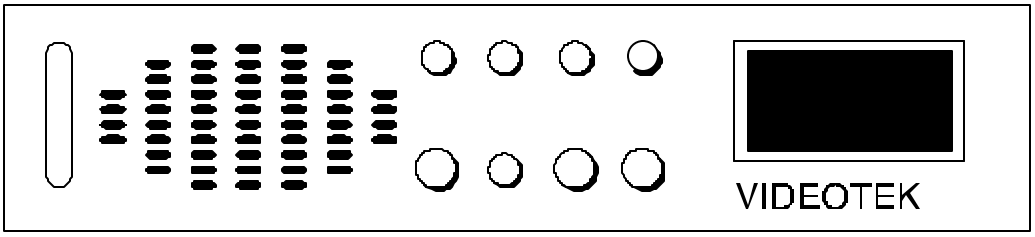


Figure 4.24, VIDEOTEK Amplifier, Front Panel



Operations

	The Wegener audio subcarrier-demodulator units and the VIDEOTEK distribution amplifier are wired for 110V AC operation. Do not turn them on until you verify that the outlet voltage is correct and that a proper circuit ground, other than the circuit ground used by the antenna, is used.

Direct optimization of the audio subcarrier-demodulator units and the VIDEOTEK distribution amplifier is not possible. Correct operation of these units is indicated when:

- The green power indicator light (DS1) on the front panel of the subcarrier-demodulator units is lighted; and
- The red automatic gain control (AGC) alarm indicator light (DS2) is not lighted.

If you see that the red DS2 light is lighted:

- The incoming RF signal from the antenna is not strong enough; and
- Re-peak the antenna by using the AGC meter of the TVRO receiver.

If you see that the DS1 and DS2 indicator lights are showing proper signal strength, but you are not getting satellite data transferred to the computer:

- The data may be coming into the computer in the inverted mode; and
- Switch the J803 jumper plug switch. Read the Wegener Receiver Instruction Manual, Figure 2.2, page 2-7, to determine the location of this plug.

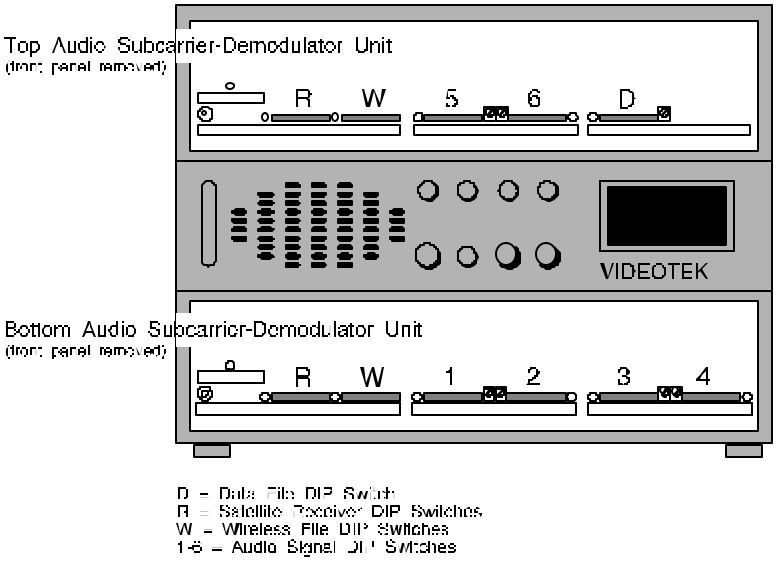
Demodulator Switch Settings

Before hooking up any cables, use the following procedures to set audio subcarrier-demodulator switch settings:

Remove the front panel from both audio subcarrier-demodulator units.

The insides of both units are very similar. The bottom unit holds three long interface cards and the top unit has two long interface cards and one short interface card. Along the front edge of each interface card are one or two dual-inline-processing (DIP) switches. The data file or `D' DIP-switch is located on a short interface card that is located to the right rear corner of its audio subcarrier-demodulator unit. Figure 4.25 illustrates the location of each DIP-switch.

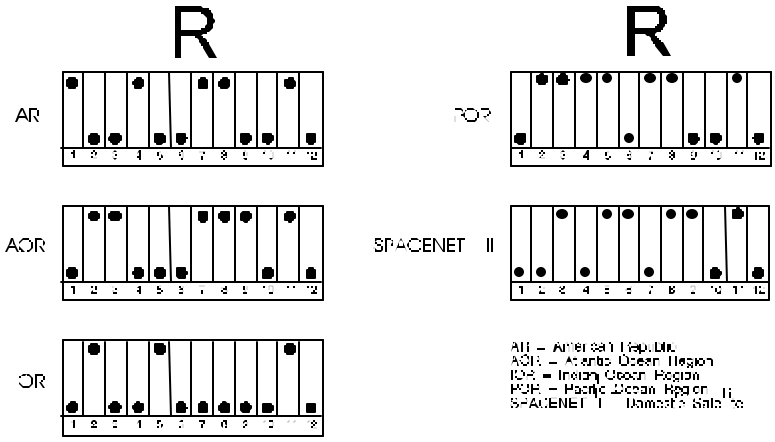
Figure 4.25, Wegener Audio Subcarrier-Demodulator DIP-Switch Locations



A DIP switch is made up of 12 separate mini-switches. The mini-switches are numbered, from left to right: 1 through 12.

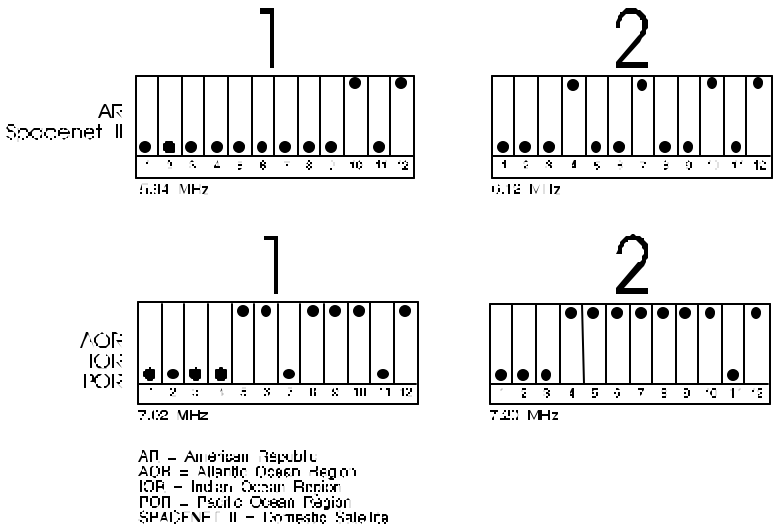
To receive the proper WORLDNET satellite signal, set the satellite receiver or `R' DIP switches on both demodulator units by moving the mini-switches to the up and down positions exactly as shown for your region in Figure 4.26.

Figure 4.26, Satellite Receiver (R) DIP-Switch Settings for WORLDNET Signal (Both Audio Subcarrier-Demodulator Units)



To receive the 15 KHz audio channels being transmitted to your region, set the `1' and `2' audio signal DIP-switches on the bottom demodulator unit. Move the mini-switches to the up and down positions exactly as shown for your region in Figure 4.27.

Figure 4.27, Audio Signal (1-2) DIP-Switch Settings for WORLDNET Signal (Bottom Audio Subcarrier-Demodulator Unit)

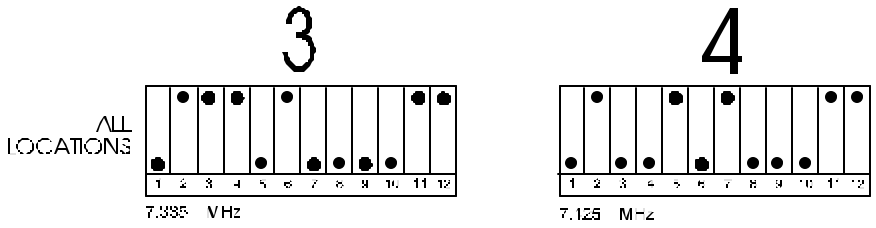


To receive the 7.5 KHz audio channels being transmitted to your region, set the `3', `4', `5', and `6' audio signal DIP-switches on the bottom demodulator unit. Move the mini-switches to the up and down positions exactly as shown in Figure 4.17 and Figure 4.18.

All USIA TVRO sites use the same audio signal DIP-switch settings for switches 3, 4, 5, and 6.

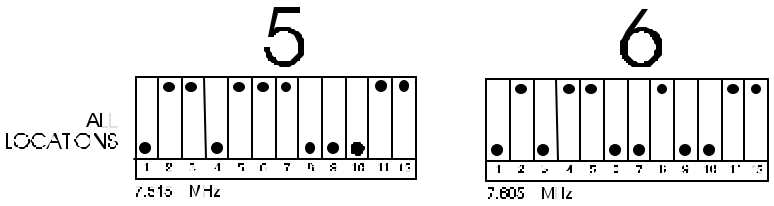
Set the `3' and `4' audio signal DIP-switches on the bottom demodulator unit by moving the mini-switches to the up and down positions exactly as shown in Figure 4.28.

Figure 4.28, Audio Signal (3-4) DIP-Switch Settings for WORLDNET Signal (Bottom Audio Subcarrier-Demodulator Unit)



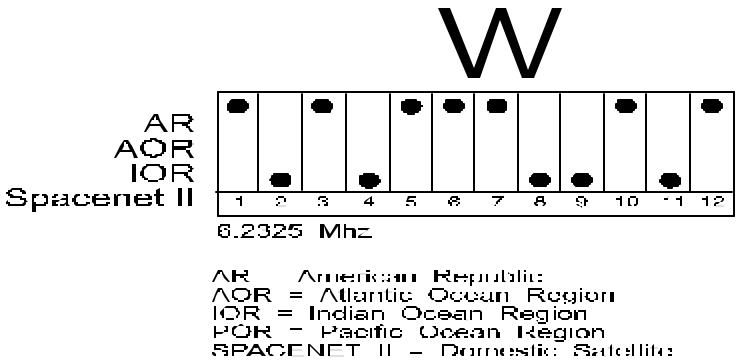
Set the `5' and `6' audio signal DIP-switches on the top demodulator unit by moving the mini-switches to the up and down positions exactly as shown in Figure 4.29.

Figure 4.29, Audio Signal (5-6) DIP-Switch Settings for WORLDNET Signal (Top Audio Subcarrier-Demodulator Unit)



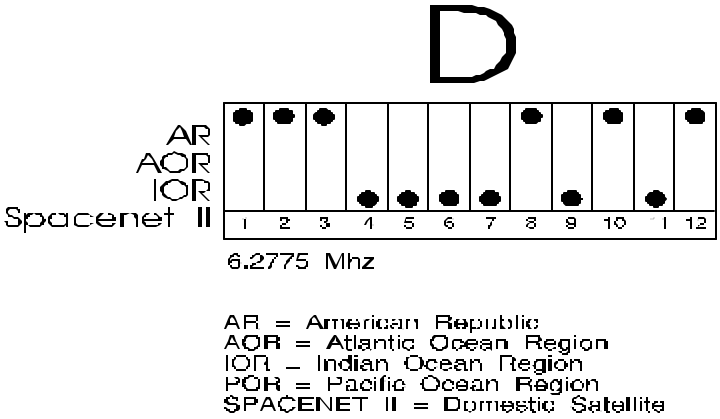
To receive the wireless file, set the wireless file or `W' DIP-switch in both demodulator units by moving the mini-switches to the up and down positions exactly as shown for your region in Figure 4.30.

Figure 4.30, Wireless File Signal (W) DIP-Switch Settings for WORLDNET Signal (Both Audio Subcarrier-Demodulator Units)



To receive the data file, set the data file or `D' DIP-switch on the top demodulator unit by moving the mini-switches to the up and down positions exactly as shown for your region in Figure 4.31. The `D' DIP-switch is located on a short interface card that is located to the right rear corner of its audio subcarrier-demodulator unit.

Figure 4.31, Data File Signal (D) DIP-Switch Settings for WORLDNET Signal (Top Audio Subcarrier-Demodulator Unit)



All signal and power cable hookups are made at the rear panels of the top and bottom audio subcarrier-demodulator units and VIDEOTEK distribution amplifier.

Cable Connections

⚠	Use the following procedures to hookup signal and power cables to each audio subcarrier-demodulator unit.

The cable connected to the RF Input terminal provides DC power to the LNB. Check manufacturer specifications to ensure that the splitter attached to the input cable is compatible with this DC voltage.

Connect the RF input coaxial cable from the splitter into the RF Input terminal.

Connect one end of the data cable to the 9-pin Data Output terminal. Connect the other end of the cable to the data input terminal on the back panel of the computer that will receive the data file.

Connect the audio cable of each audio subcarrier-demodulator unit to the VIDEOTEK distribution amplifier.

Connect audio cables from the audio subcarrier-demodulator units to recorders.

Connect telephone cables from the audio subcarrier-demodulator units to adjacent telephones to be used for monitoring the incoming audio signals.

⚠	The Wegener audio subcarrier-demodulator units are wired for 110V AC operation. Do not plug them into any outlets until you verify that the outlet voltage is correct and that a proper circuit ground, other than the circuit ground used by the antenna, is used.

Plug the female end of the power cord into the 110V AC power cord terminal. Plug the male end of the cord into a power strip or 110V AC wall outlet.

Other System Receivers

MASPRO System Receiver

Overview

MASPRO system receivers are presently installed at 30 percent of all TVRO sites in the Near East, and East Asia. They provide excellent broadcast quality and sensitivity. The model SRE-800A is presently the standard-issue system receiver for new sites, and it is used to replace older Drake system receivers as they break down.

Features

The model SRE-800A has the following features:

- A frequency tuning digital switch with a frequency range of 950 to 1750 MHz;
- A combined signal level/center tuning meter; and
- A separate LNB powering switch on the rear panel.